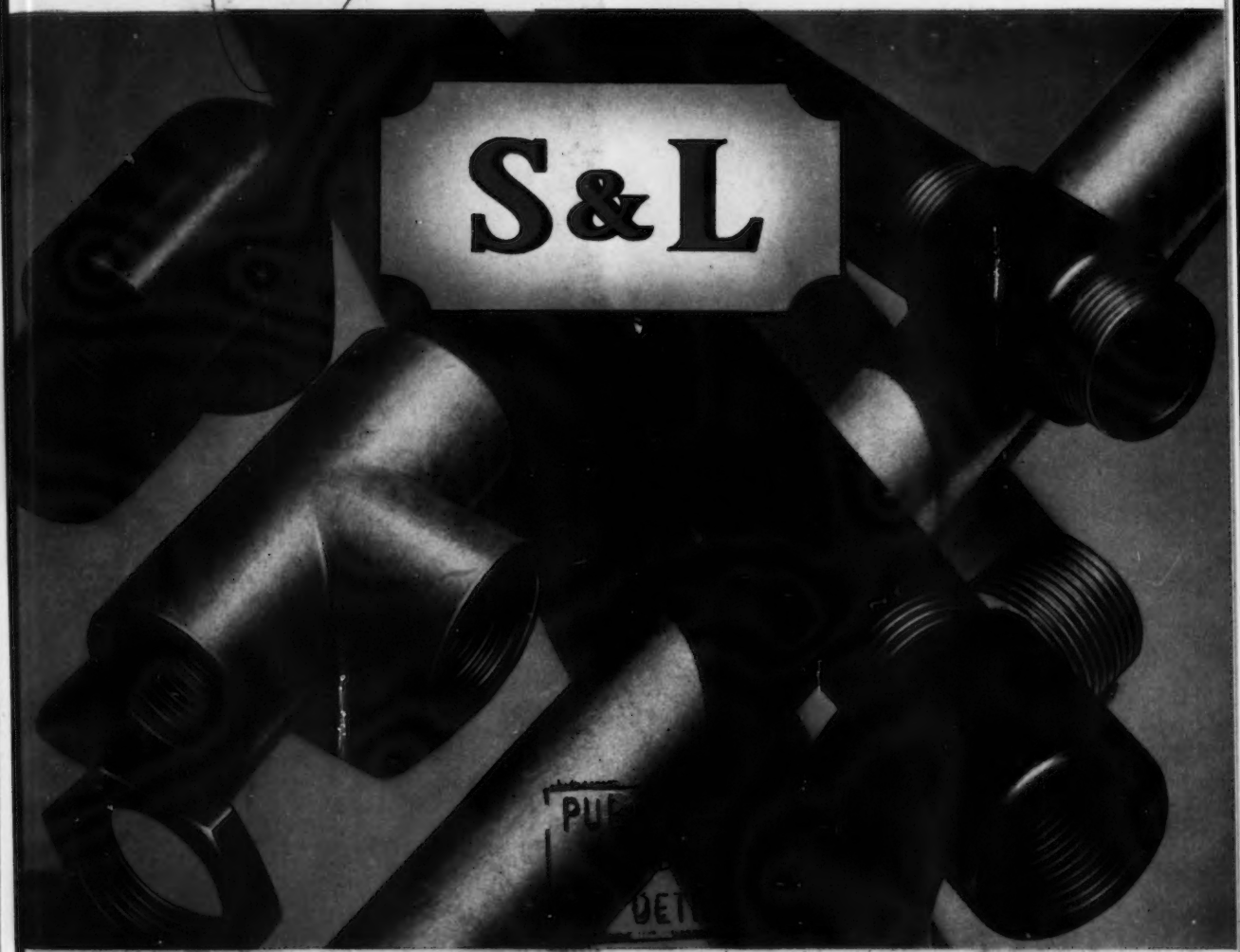
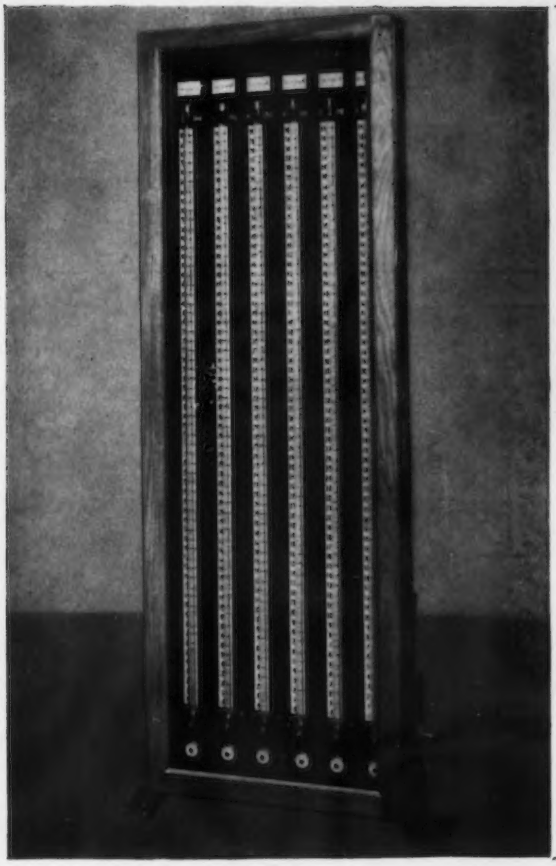
HNOLOGY DEPT

Gas Journal

VOL. 289. 109th YEAR. LONDON, JANUARY 9, 1957. Nº 4878. PRICE 1/6



STEEL TUBES & FITTINGS
STRONGEST AND CHEAPEST



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FOR

THE GAS AND CHEMICAL INDUSTRIES

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BTR hot sinter conveyor belt at a Northern steel works.

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1 hr. to 720 hr.

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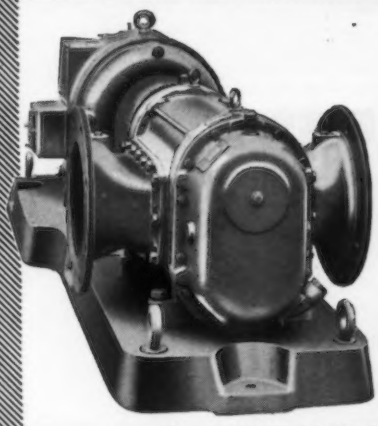

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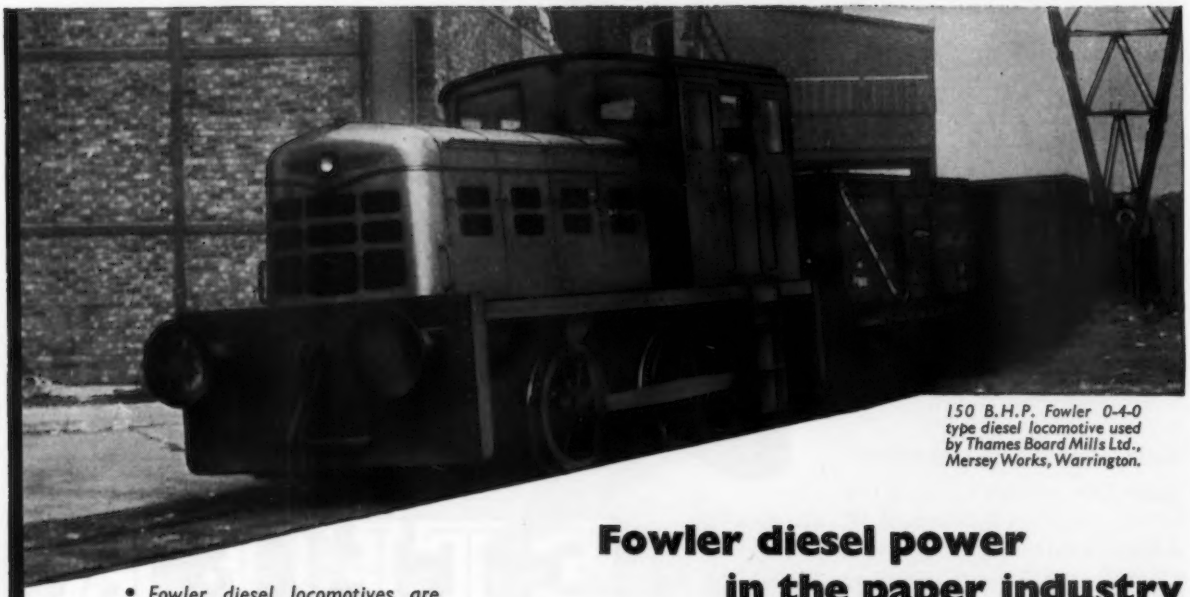

150 B.H.P. Fowler 0-4-0 type diesel locomotive used by Thames Board Mills Ltd., Mersey Works, Warrington.

Fowler diesel power in the paper industry

Also in use in 42 other major industrial undertakings in Great Britain

- *Fowler diesel locomotives are ideal for all industrial purposes, general or specialised.*
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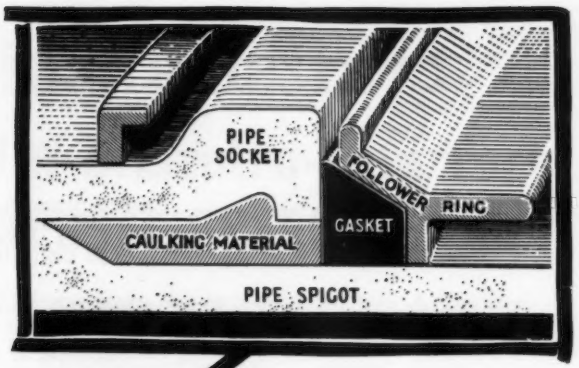
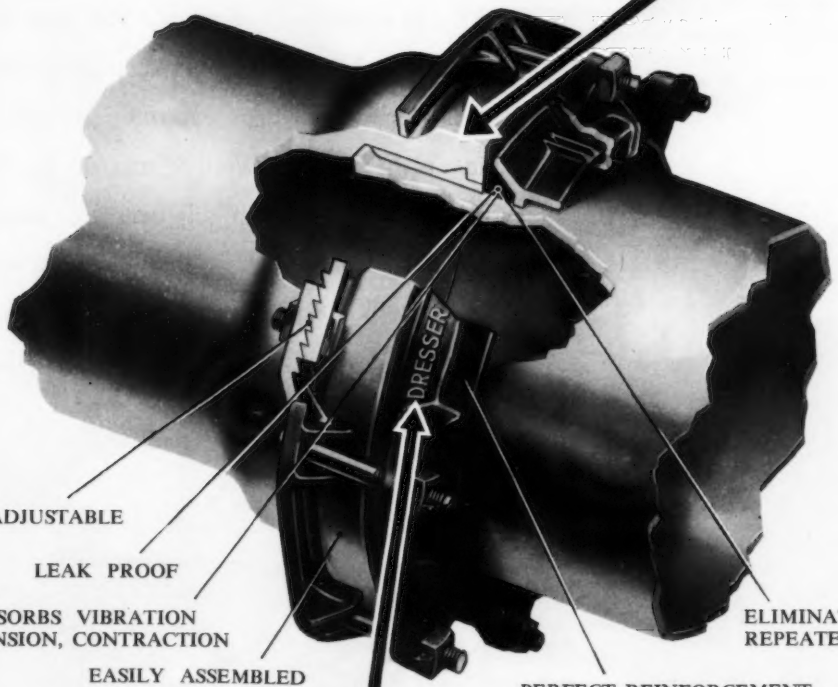
Why it's better to fit DRESSER STYLE 60 CLAMPS





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craftsmanship in steel...

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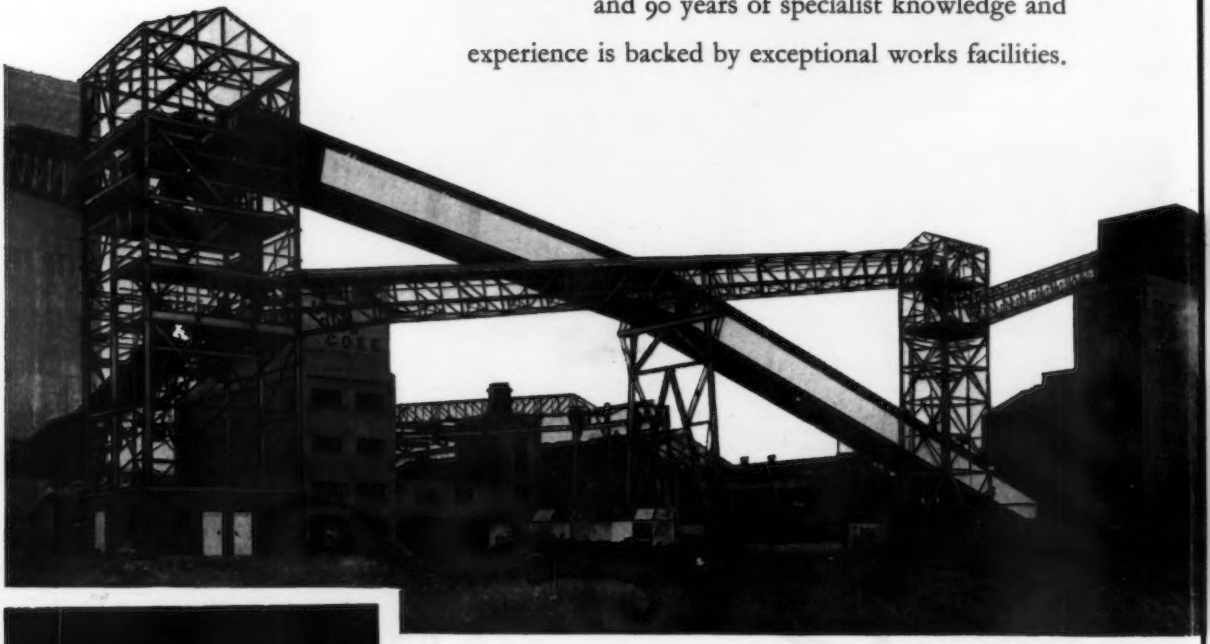

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Structural Engineers

ESTABLISHED 1867

if it can be built in steel—we can build it

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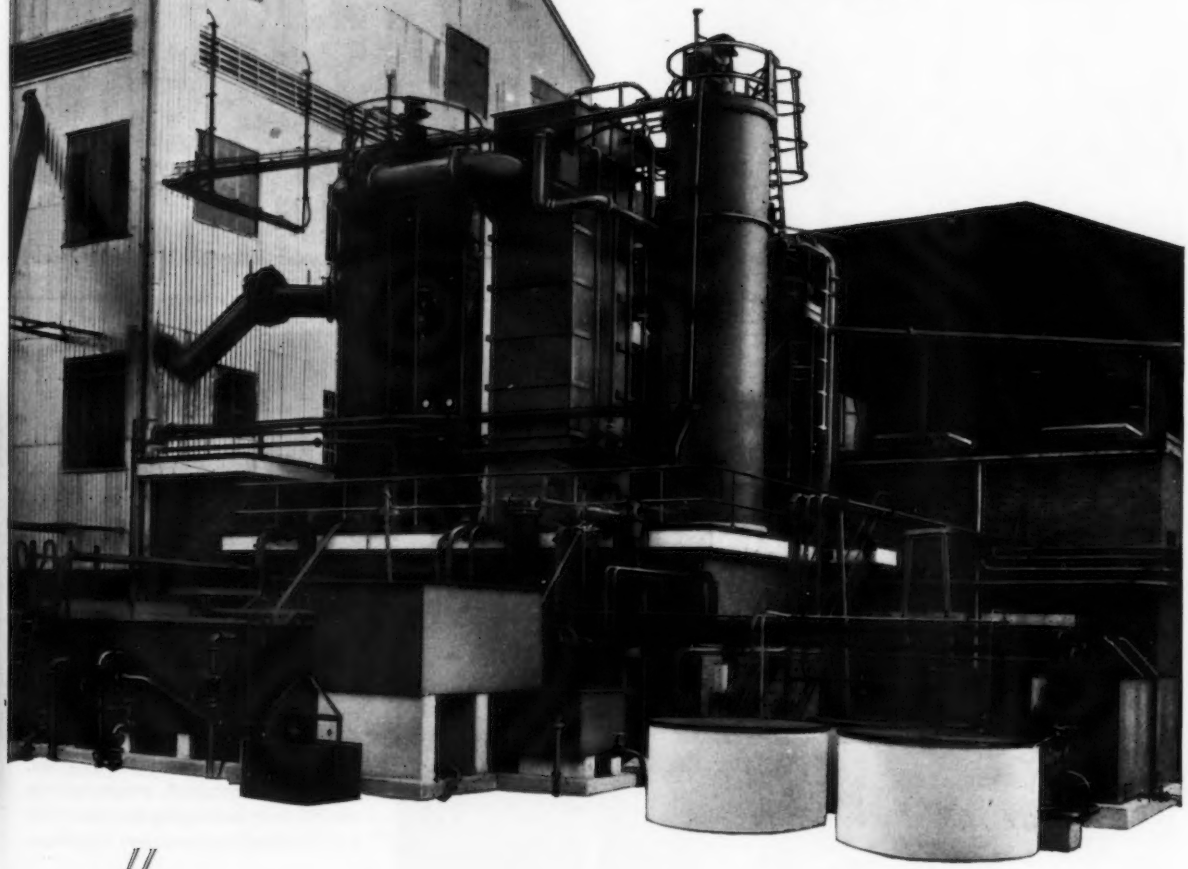
WHESSOE

Condenser and W.W-D. Electro-Detarrers now working at KENSAL GREEN

The primary gas cleaning plant for the W-D/I.F.E. Complete Gasification Plant (G.I. System) at Kensal Green comprises a hot gas W.W-D. electro-detarrer, a vertical tube parallel flow condenser and a cold gas W.W-D. electro-detarrer.
This plant, which handles more than 2½ million cubic feet of gas per day, was designed, fabricated and erected by Whessoe. A notable feature of this order from the Woodall-Duckham Construction Co. Ltd. is that all the units are operating on cyclic gas-flow before the relief holder.

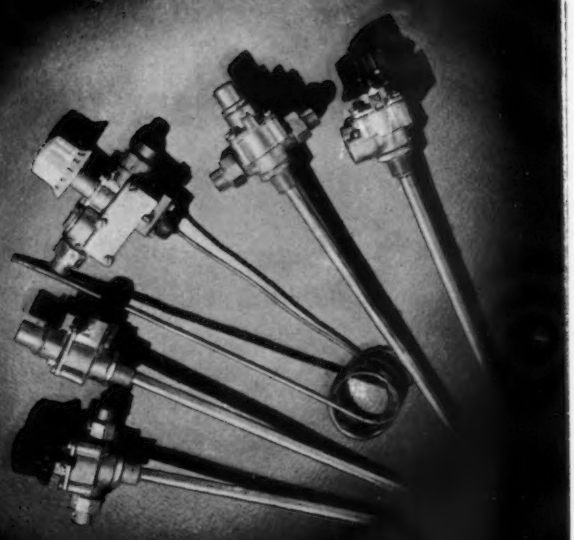


WHESSOE CAPITAL PLANT FOR THE GAS AND COKING INDUSTRIES

An advertisement of Whessoe Ltd., Darlington and London

W 84

Spotlight on
EVERSTATS



These thermostats are examples from the comprehensive range of gas controls now being supplied to the leading manufacturers of domestic and industrial appliances.

EVERED & COMPANY LIMITED, SURREY WORKS, SMETHWICK 40, STAFFS.

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BORED PILES FOR THE N.F.U. KNIGHTSBRIDGE SITE

The heavy foundation loading from this building made normal footings for the columns out of the question —a condition frequently obtaining to-day when higher storeys are permitted. Piling was necessary and the close proximity of other buildings, including a Hospital, precluded the use of heavy driving equipment with its accompanying noise and vibration.

Cementation Bored Piles were selected by competitive tender and the foundation work was completed very successfully notwithstanding the difficult ground conditions unexpectedly encountered.

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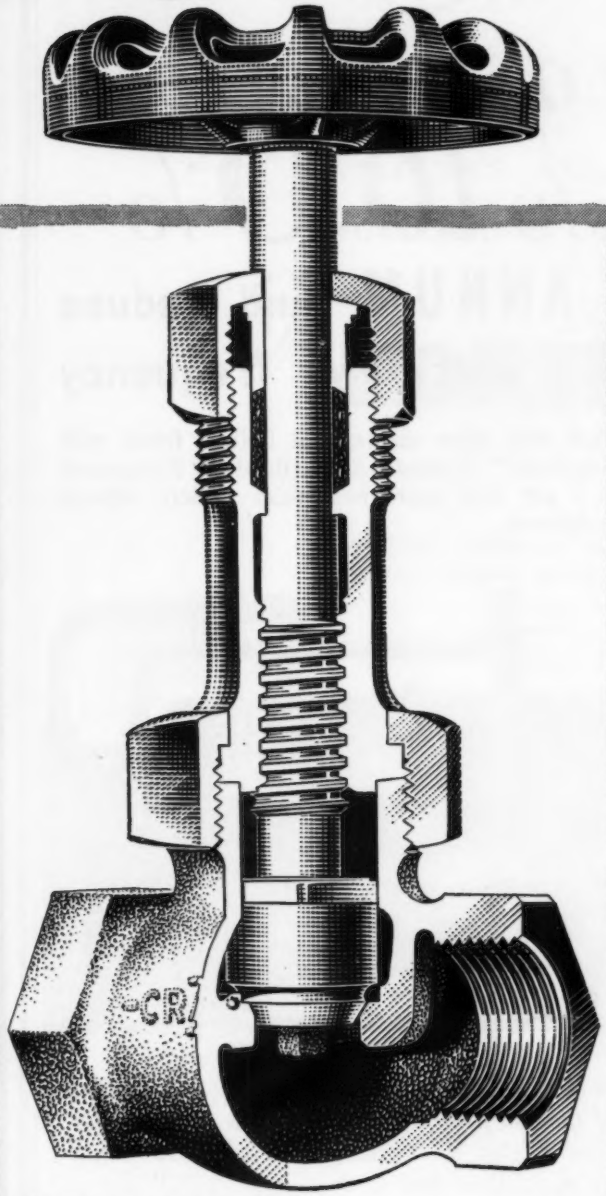
For High Pressures



D20 Sizes ¼" to 2"

Hexagon ends with British Standard Taper Threads or to American Standards where specified. Working pressures: Steam up to 300 pounds, 550° F. Water, oil or gas (cold, non-shock) up to 600 pounds. *Crane Bronze Check Valves D. 122 or D. 145 are recommended for use with these valves.*

CRANE BRONZE GLOBE VALVES

Regrinding— Union Bonnet

Manufactured from high grade metals to Crane Standards, these new Bronze Globe Valves have the important advantage that they can be reground whilst in position, without removing the body from the line. Designed for operation under severe conditions and at high pressures, they are well suited for service on steam, water, oil or gas services. The union bonnet, in addition to making a tight sturdy joint, also facilitates dismantling and reassembly, whilst the union ring reinforces the bonnet joint, as well as centering and guiding the valve trimmings during regrinding. Other features include the back-seating, which allows the valves, when wide open, to be repacked under pressure.

These valves, like all Crane products, are individually subjected to searching tests before leaving the factory, thus ensuring their consistent high quality.

CRANE

VALVES OF BRONZE, CAST IRON AND CAST STEEL

V.4.

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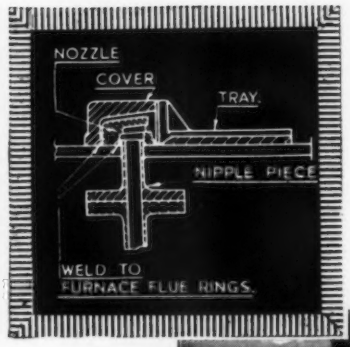
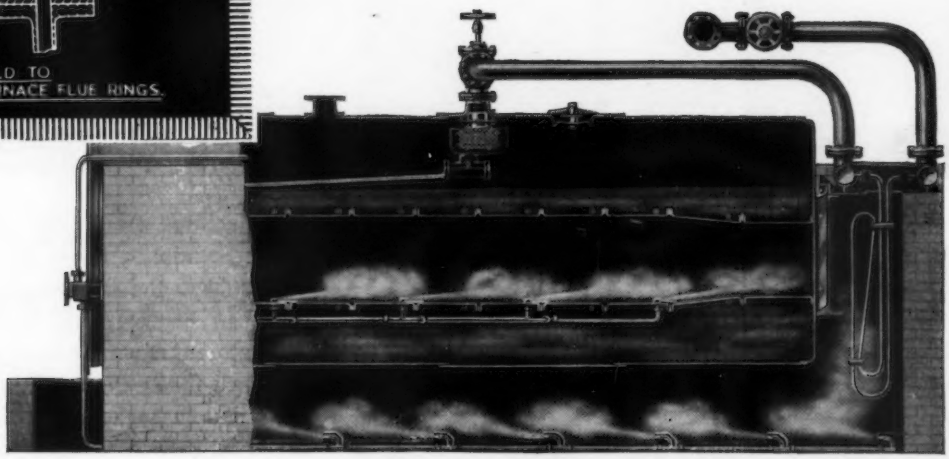
SAVE FROM 4% to 6%

OF COAL PER ANNUM and reduce boiler shut-down frequency



Repeated tests have shown that boilers fitted with "Bolton-Gray" Patent Ash Blowing Equipment absorb 7 per cent more heat than boilers without this equipment.



Bolton's
OF STOCKPORT

"Bolton-Gray" Patent Ash Blowing Equipment removes the ash from the internal flues of the boiler while the boiler is working. *Boilers so fitted maintain continuous fuel saving.*

This equipment is readily fitted; without obligation may we send fully informative literature?

Every Engineer in charge of a Boiler House should have a copy of this publication.

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TIPTON, STAFFS. CROYDON AND SHEFFIELD

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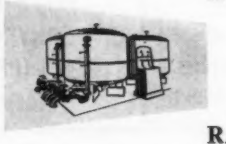

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HORSELEY GROUP

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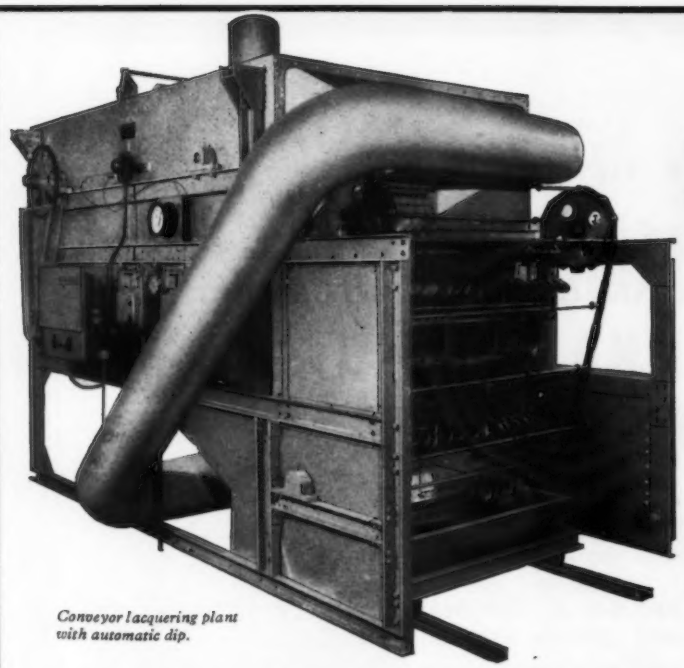

Conveyor lacquering plant with automatic dip.

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ENAMELLING OVENS
AND
CONVEYOR ENAMELLING PLANT

ALSO MANUFACTURERS OF STEEL PLATE GAS MAINS AND FABRICATED STEEL STRUCTURES FOR THE GAS INDUSTRY

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ESTABLISHED 1850

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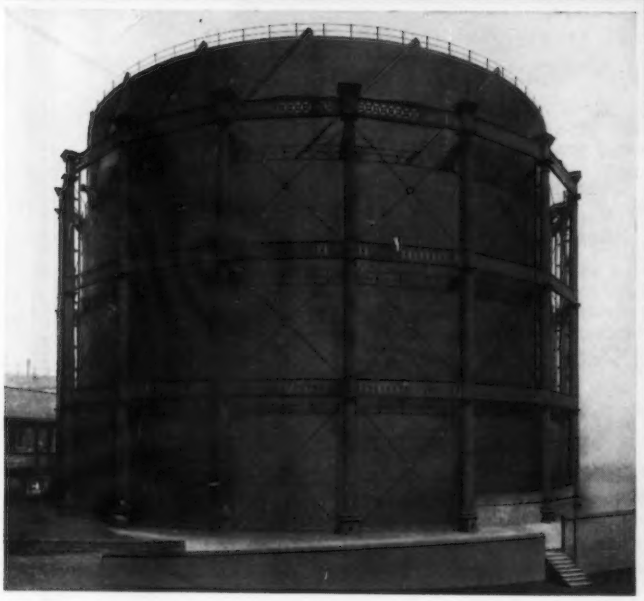

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Internal deck level view of the Purifier Installation.
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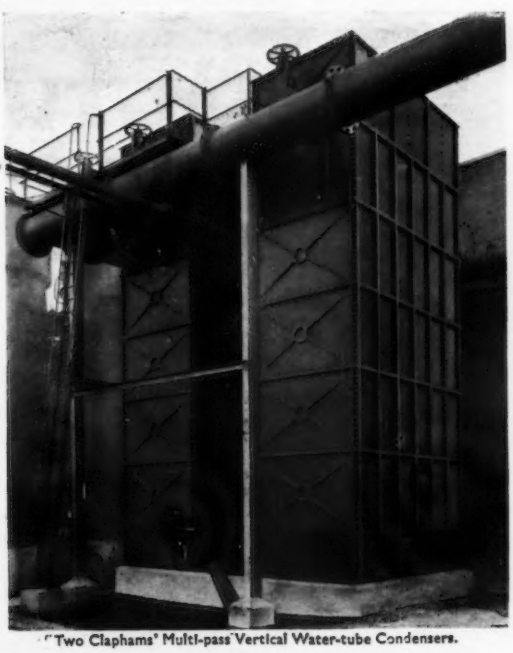

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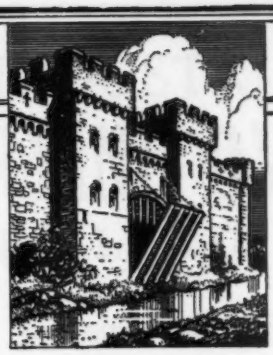

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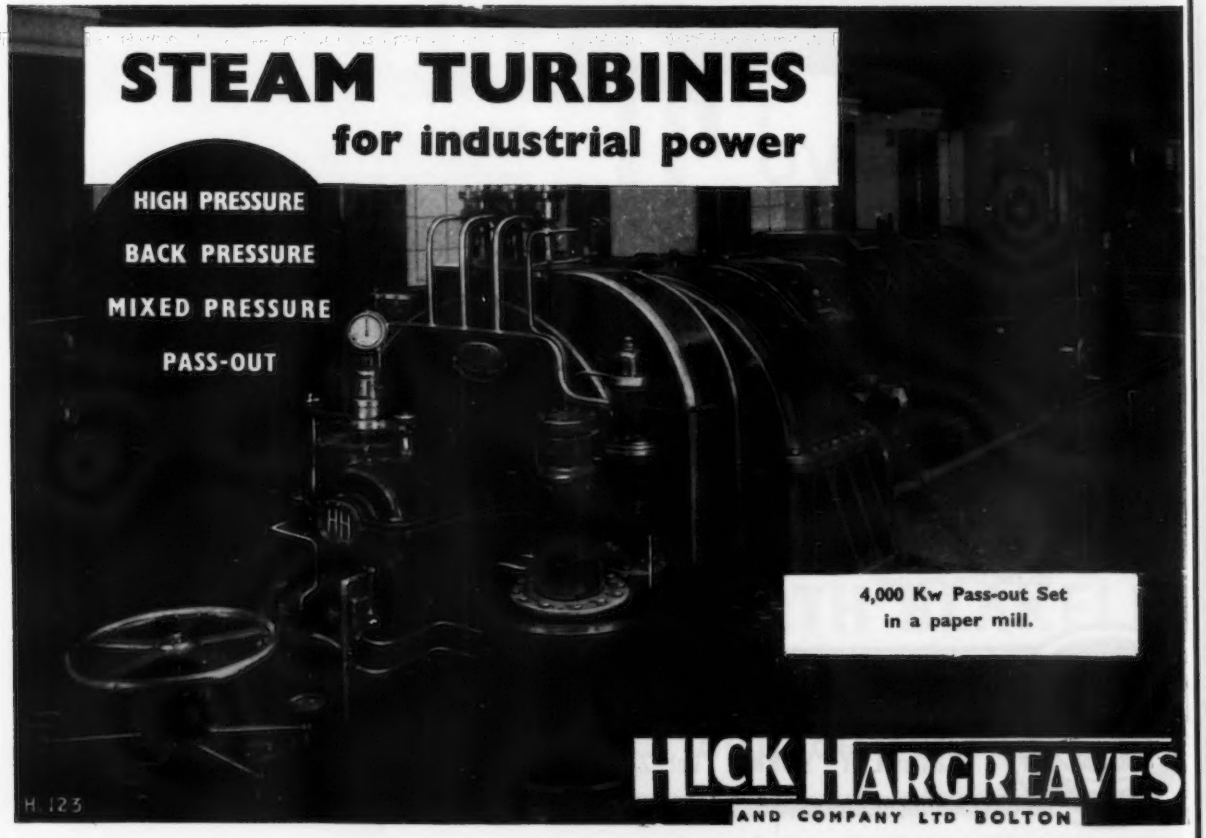
STEAM TURBINES
for industrial power

HIGH PRESSURE
BACK PRESSURE
MIXED PRESSURE
PASS-OUT



4,000 Kw Pass-out Set in a paper mill.

H 123

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AND COMPANY LTD BOLTON

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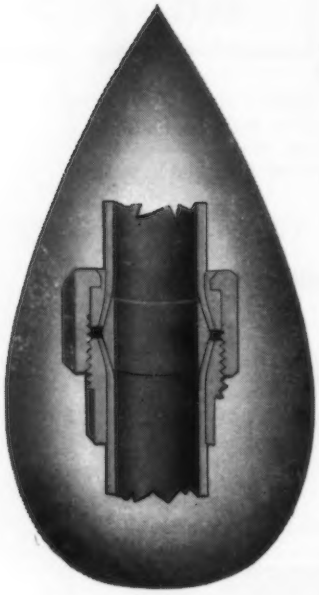
SOLDERLESS COMPRESSION JOINTS

Streamline the inside



A piping system needs smooth obstructionless flow for maximum efficiency, and SECUREX joints ensure a clear streamlined passage with no roughness or projections to accumulate fur or rust. Easily fixed, self-adjusting to varying pressures, SECUREX joints are available for gas, water, steam and hydraulic systems. Write now for full details of the SECUREX range and cut costs and time the modern way.

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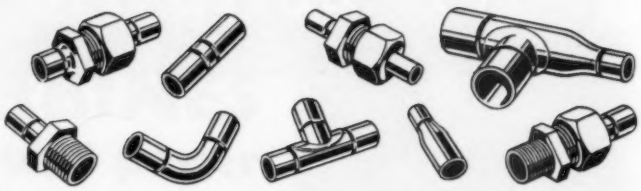

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Five 8 in. diameter aviation refuelling mains at Shannon Airport. Primed with Denso Paste and wrapped with Denso Tape, welded joints are now being protected.

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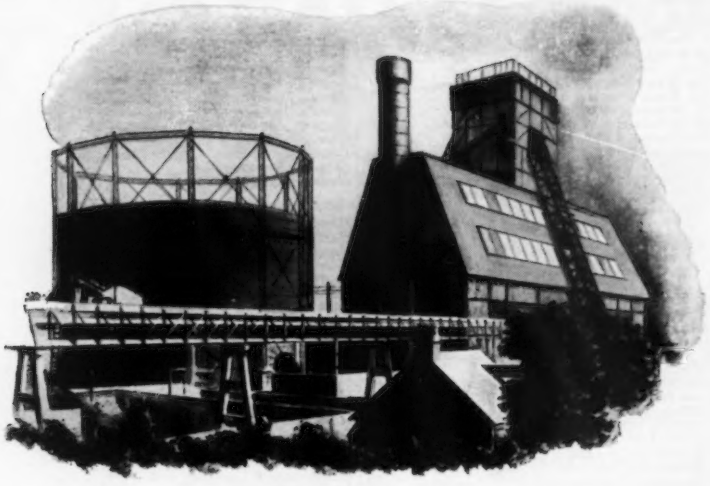

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Gas Journal

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109TH YEAR

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PUBLISHERS' NOTICE, See Page 49, January 2, 1957

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Gas Journal

VOLUME 289. No. 4878. JANUARY 9, 1957. 109th YEAR

Where Are We Going?

THERE is a great deal of speculation among 'interested parties' concerning the future of the gas industry. Is it, as some suggest, going into a slow decline? The electricity industry believe this, having reluctantly given up the belief that we were going into a quick one. Or is it, as others assert, a basic industry in that the nation cannot live without the products of carbonisation? Perhaps a more accurate definition of this viewpoint is that since we cannot live without the by-products we must put up with the products! There is, too, the 'strength through coke' school which maintains that since the imminent enforcement of Clean Air must rely on a very substantial production of coke the gas industry has a vital part to play at least until atomic power comes within the reach of all. Let us worry about what happens next when the time comes, says the coke cult. And lastly there is the true blue gas industry view, still surprisingly widely held if you scratch below the surface, that there has always been a gas industry—well, almost—and dash it all, you just cannot imagine life without it; like monarchy it is part of the British fabric.

It may have struck the gentle reader that these four widely differing views have one thing in common—not one of them takes into consideration the views of the public. The blunt truth is that public opinion is very seldom the final arbiter nowadays. Nevertheless, it is surely true that, provided coal supplies remain adequate and the public wants it, there is no reason why the homes of Britain should not continue to use gas for heating and cooking for many years to come. There are two reasons why gas may be demanded—because it is preferred to other fuels, or because it is cheaper than other fuels. Alas, the chances of the latter are somewhat slight. But there is no reason why, provided certain things are done, the public should not prefer gas to competitive fuels. Let us examine such a preference in greater detail.

We know that, price apart, the fuel we are offering is very nearly ideal. It would become ideal if certain improvements could be made. Two of those improvements are basic or mechanical, and the other is promotional. Gas will never be a perfect fuel until the sulphur content has been further reduced and until it has become possible to reduce the dangers inherent in its use. At the risk of angering those who have laboured long and hard to overcome the sulphur problem and have come up against the blank wall of alleged economic impossibility, we maintain that, fundamentally, nothing has been done about it. Indeed, there is a substantial school of thought which likes to pretend that the problem does not exist. As a result gas is classed by its critics as a dirty fuel and appliance manufacturers are seriously frustrated in their efforts. Equally the very serious incidence of gassing accidents is not a difficulty we can overcome by thrusting our heads in the sand. The third necessary improvement is purely one of sales promotion and technique.

It is safe to say that no other industry or organisation in this country could or would run its sales machine in such an extraordinary fashion. (Electricity boards, although in our view rather worse in this respect than gas boards, are supported in the sale of their basic product by a vigorous force of dealers.) In the first place there is no real national commercial policy since the Gas Council does not possess a commercial manager. The chief sales officers of the various gas boards meet to form the Commercial Managers' Committee which achieves a fair degree of unity over sales matters, but nowhere is the autonomous nature of the boards more apparent than in their attitude to selling. It is a fantastic thing that not until now, more than seven years after vesting day, has the industry achieved uniformity of appliance prices—one of the most elementary rules of marketing. Moreover, there is not and never has been any influx of sales personnel from the outside world, while the home-grown product is in most cases trained as a fitter or a technician rather than as a salesman, in direct opposition to the widely accepted belief that the two jobs require entirely opposing personalities and training.

And what of the appliances we sell? Much of our future success with the public will depend on the extent to which these appliances keep up with the technical developments of those of our competitors. Our system of appliance testing is rightly a stringent one, but is it conducive to perfecting and approving appliances with

the maximum speed necessary to keep up with the race of domestic appliance development? Gas appliance manufacturers have plenty to put up with, hamstrung as they are by the unjust imposition of purchase tax and hire purchase restrictions, while solid fuel appliances go scot-free and oil heaters enjoy an undeserved and unjustified boom; they can ill afford delays which rob their products of the precious ability to catch the market at the right time.

There are signs that the virtual monopoly enjoyed by gas in the sphere of cooking is being seriously threatened. In our view this threat could be removed, or if not removed, kept at bay by some drastic re-styling of some of the gas cookers on the market and a clear decision to follow electricity into the realm of gadgetry if and when it suits our book to do so; from a marketing angle there is no longer a case for the purist approach to gas cooker design. Gas water heating has an important part to play in our future economy while home laundry business demands further development in clothes drying. But it is in the field of space heating that much new thinking must be done. In recent years we have suffered from an inferiority complex over the cost of space heating by gas (we are not thinking here of central heating for which the expense of gas as a fuel makes it extraordinarily difficult to sell) and have done irreparable damage to gas fire business by our efforts to sell coke grates which, as we must all know by now, are seldom used exclusively for coke. We believe that the use of gas for space heating, even at today's price per therm, could have a very bright future on the grounds of efficiency and convenience. But it needs a fresh approach to the public.

If we are correct in our assessment of the present position it is abundantly clear that the gas industry must rediscover its sense of direction in a rapidly changing landscape; it must know where it is going and why. Our fear is that unless this reawakening to our destiny can be achieved soon, a golden opportunity will pass and gas will fall into the ignominy of a second-rate power.

Youth and the Gas Industry

THE sixth Christmas Lecture for young people was given by Mr. G. H. Fuidge, Chief Physicist to the South Eastern Gas Board at the Sir John Cass College on Tuesday, January 1. Choosing as his subject 'The By-products of Coal,' Mr. Fuidge dealt very fully with the properties of coal itself, how it could be converted into a form of active carbon for use in gas masks or as a discolouriser, as well as its properties under conditions of carbonisation, with the formation of gas and by-products. The audience were enthralled from the moment the lecture began. Present were young men and women in the middle teens, together with some science teachers or interested parents, and senior officials of the gas industry. The President of the Institution, Sir Henry Jones, introducing the lecturer, explained his position in the gas industry and his qualifications to speak on this particular subject, in this way showing the importance the gas industry attaches to these lectures.

Mr. Fuidge demonstrated the process of high temperature carbonisation on a laboratory scale, in which the general gasworks processes were being carried out, such as scrubbing the gas for ammonia, tar extraction, purification, and the effect of benzole recovery on the luminosity of a gas flame. He then went on to his main subject of the commercial use to which the by-products recovered at each stage could be put. Throughout the proceedings Mr. Fuidge's assistants worked with perfect timing so that used apparatus was removed, concealed, and replaced by what was needed for the next demonstration with no distracting time lags.

The lecturer dealt with the primary by-products, such as ammonia, either as sulphate or concentrated liquor, refined tar, tar oils and other distillation products, and benzole. These products, Mr. Fuidge pointed out, were obtained from the substances recovered by purely physical means and must be clearly kept separate in the mind from secondary by-products which are the result of secondary chemical reactions. Ammonium sulphate should be considered the exception as its reaction with sulphuric acid merely represents a convenient means of handling a large bulk of dilute solution or a gaseous material in a form that would otherwise be useless for its chief purpose as a fertiliser. It was only by attacking some of the tar and benzole distillation products by the more violent reagents such as strong acids or alkalis that the family of dyestuffs, the aniline dyes, could be formed; once this had been done, a process described as 'putting on reactable ends to the molecules,' more important and more valuable derivatives of the coal tar products could be formed.

This is a most valuable point to have made since a number of laymen and semi-technically minded people are liable to forget that the by-products from coal and coal tar distillation are only raw materials for further chemical synthesis, and it is entirely due to the ingenuity of the organic chemist of today that so many derivatives from coal and oil by-products are in common use. The great plastics industry, and the production of nylon, terylene and other polymers made from comparatively simple substances, are perhaps the most outstanding contributions made by modern methods of synthesis to our standards of life.

It is very encouraging to see the Institution of Gas Engineers attaching importance to bringing the gas industry to youth so attractively each year. Each lecture deals with a different aspect of the industry's activities, and although it is unlikely that the same people make up the audience each year, the lectures are being given by experts in the industry who should make a far greater impact than any textbook likely to be in the possession of a student or schoolboy. The activities and strivings, research work and practical application of all new ideas can be shown to the younger generation. The lectures might well influence young people to consider entering the gas industry and might also do much to prevent the idea that only a career in the production of atomic power is worthy of their attention.

Into whatever industry young men and women enter, they must accept the discipline of that industry. Sir Henry Jones referred to this in a most charming way when he proposed a vote of thanks to Mr. Fuidge and said that at school, boys and girls should be taught to handle reagent bottles in a certain way and he had been most impressed to see that throughout the lecture Mr. Fuidge's assistants had handled everything from beakers to bottles of sulphuric acid according to the 'book.'

Correspondence

COLLAPSE OF THE KINGSGROVE HOLDER

DEAR SIR,

It was with considerable interest that the writer read in the December 19 issue of the 'GAS JOURNAL' the article by Mr. N. G. Mather entitled 'The Collapse of the Kingsgrove Holder' and the second opinion by Mr. A. Fekete.

This letter does not propose to comment on the design of gasholders, but it will refer to the comments listed on p. 708 and in particular the comment numbered 4. Mr. Mather suggests that gasholder tanks should not be welded where the bottom straight plates are thicker than say $\frac{1}{4}$ in., and reinforces this opinion by stating that there are strong arguments for using rivetted steel tanks.

This comment is most surprising because it suggests that Mr. Mather had not read Professor Shank's[1] paper to the Committee on Ship Structural Design. In Professor Shank's report there are recorded many brittle failures, the first occurring as long ago as 1879. It is interesting to read that many of the failures occurred in rivetted fabrications and there are also excellent photographs which show that in some cases the rivetted crack arrestors introduced into the Liberty ships did not stop the propagation of cracks.

It might also be of interest to record that in 1912 there was a gasholder tank failure at Ilkeston. The tank of this gasholder measured 115 ft. in diameter by 26 ft. high. At the time of the enquiry into the failure the probable cause was not determined, but in the light of present day knowledge it would appear that the failure was most likely to have been due to a brittle fracture. The night before the failure of this tank there was recorded 7° of frost.

The reduction in the notch ductility properties of steels as temperatures approach freezing point is one of the most important factors associated with the cause of brittle failures. It is therefore not surprising that considerable attention has been devoted to the manufacturing of steels having improved notch ductility properties at low temperatures. The heavy steel plate manufacturers, the oil companies and fabricators to the oil companies produced a series of specifications which have recently been incorporated into the British Standard Specification 2762 (1956). The steels made to this specification are based upon a guaranteed Charpy 'V' Notch impact value of not less than 20 ft. lb. at steadily falling temperatures. The temperatures for 20 ft. lb. Charp 'V' Notch, for ND_1, ND_2, ND_3 and ND_4 are respectively 0°C., −15°C., −30°C. and −50°C.

In addition to recognising the need for a steel which would reduce the probability of the propagation of a brittle fracture, informed fabricators in this country have also recognised the importance of producing X-ray sound welds.

Summarising, there is an abundance of experience available in America and Great Britain to show that if the highest quality materials and workmanship are adopted then plates thicker than those that can be rivetted can be welded satisfactorily.

Finally, regarding the failure of the Kingsgrove holder, it would be interesting to know whether the corroded plates had been pickled and painted, for it is certain that if these plates had been treated in such a way then their life would have been considerably increased.

Yours faithfully,

W. C. HOLLIDAY.

Welding Engineer,
Whessoe Ltd.,
Darlington.
December 31, 1956.

[1] Shank—'A Critical Survey of Brittle Fracture other than Ships,' presented to the Symposium on Metallic Materials at Low Temperatures 56th Annual Meeting, A.S.T.M., Atlantic City, N.Y.

ELECTRICAL TARIFFS

DEAR SIR,

I was glad to see the unfairness of electrical tariffs discussed in your editorial of December 26. Under conditions of cut-throat competition, a firm which has a monopoly in one sector of its trade would be justified in keeping prices high there in order to wipe out competitors in other fields. The fuel industries have, however, been nationalised owing to the vital need to ensure that our limited resources are put to the best use. Would not the Gas Council's publicity men be better used in telling the public the blunt truth about this situation, than in their present task of persuading the public to use less gas and coke—advice which, unfortunately, appears hardly needed?

Increasing efficiency and increasing cost of power stations is widening the difference between the costs of supplying peak-load and off-peak electricity—atomic power will further widen this difference. Their smaller consumers use electricity mainly for lighting, which is almost entirely off-peak—what justification can there be for charging these people 6d. a unit? The extravagant user can reasonably consider that lighting is paying his fixed charge, so that his fire, his water heater and his cooker are supplied at 1d. a unit, which is less than the price paid by industrial users taking electricity throughout the 24 hours. Industry and small domestic consumers are paying an exorbitant price for the current they use.

In 1952, Gerald Nabarro, an M.P. who has really thought about fuel problems, suggested that electrical tariffs should be 'demotional,' i.e., the price should rise to large consumers who use electricity for purposes for which it is extravagant in coal usage. In view of this, can it be maintained that a uniform price for all consumers, large and small, would be unreasonable?

At present prices, our domestic load is certain to continue its downward path. Mr. Therm may be gratified to know that he is qualifying for the epitaph 'Always a perfect gentleman,' but it is in the national interest that he should remain alive and kicking—hard.

Another suggestion is that we might give gas consumers priority in coke supplies, both in quality and quantity, as they are helping to pay the cost of its production. The Gas Act merely requires us to avoid *undue* preference in coke supply.

Yours faithfully,

'SCEPTICAL CHEMIST.'

London.
December 31, 1956.

Diary

January 10. — INCORPORATED PLANT ENGINEERS, NORTH EAST BRANCH: Roadway House, Oxford Street, Newcastle-upon-Tyne. 7 p.m. 'Space Heating,' F. W. Watson.

January 11. — SCOTTISH WESTERN JUNIORS: 522, Sauchiehall Street, Glasgow, C.2. 7.15 p.m. 'Ladies' Night.' Paper by Miss S. McDonald.

January 12. — EAST OF SCOTLAND JUNIORS: Dundee. Short Paper Day.

January 15.—INSTITUTION OF CHEMICAL ENGINEERS, NORTH WESTERN BRANCH: The Grosvenor Hotel, Chester. 7 p.m. 'Vacation Training for Chemical Engineers,' A. J. Carter.

January 16.—SOUTH EASTERN G.C.C., Kent County Division: S.E.G.B., King Street, Maidstone. 2.30 p.m.

January 16.—INSTITUTION OF CHEMICAL ENGINEERS, NORTH WESTERN BRANCH: The University, Leeds. 7 p.m. 'Equilibrium Flash Vaporisation of Coal-tar and Coal-tar Fractions,' D. K. H. Briggs and F. Popper.

January 17.—EASTERN JUNIORS STAMFORD: 'Industrial Space Heating,' C. A. Lewis.

January 17.—MIDLAND JUNIORS: Visit to works of the Incandescent Heat Co. Ltd. Smethwick. 2.30 p.m.

January 18. — INCORPORATED PLANT ENGINEERS, BIRMINGHAM BRANCH: Imperial Hotel, Temple Street. 7.30 p.m. 'Arc Welding,' lecture and film.

January 19.—LONDON AND SOUTHERN JUNIORS: Visit to South Eastern Gas Board Acid Works, Phœnix Wharf.

Personal Notes

MR. D. RIDER, O.B.E., has resigned his position as Joint Managing Director and has retired from the Board of Woodall-Duckham Construction Co., Ltd., at December 31, 1956, in accordance with the retirement rules of the Company. He will retain his Directorship of the parent company — Woodall-Duckham, Ltd. Mr. Rider joined the Staff of Woodall-Duckham Construction Co., Ltd., in 1912 and was for many years in charge of the sales department for coke ovens; he served as a Director for 33 years and has been Joint Managing Director since 1948. MR. F. P. DYSON has been appointed Joint Managing Director of Woodall-Duckham Construction Co., Ltd., as from January 1. He joined the Company in March, 1927, as an outside engineer and was appointed Engineer-in-Charge of the drawing office in 1940. In 1946 he was appointed Chief Engineer of the construction department. He joined the Board in 1949. Mr. Dyson is at present Chairman of the Refractory Users' Federation. MR. C. D. MUNTZ and MR. E. N. WENBORN have been appointed Directors of Woodall-Duckham Construction Co., Ltd., as from January 1. Mr. Muntz, following several years experience with civil engineering contractors, joined the Company in 1928 as an outside engineer and was subsequently transferred to head office. On January 1, 1956, he was appointed Deputy to the Director-in-Charge of the construction department. He now takes over control of that department. Mr. Wenborn joined the Company in 1924 and has served in the drawing office and construction departments. In August, 1953, he joined the supplies and services department as Deputy to the Director-in-Charge and took over control of that department in January, 1955.

W. GEORGE HEAD, senior Project Engineer, Humphreys & Glasgow Ltd., retired on December 31. Born in 1881, and educated at St. Laurence College, Ramsgate (then called the South Eastern College), and afterwards at the City and Guilds Technical College, Finsbury, which was afterwards absorbed by the Central Technical College, South Kensington, he began work in a large engineering works in Westminster, after which he was appointed a junior assistant by the late Sir George Livesey at the Old Kent Road gasworks. In 1905 the company sent him to the U.S.A. in connection with thorium, used for incandescent gas lighting. On his return to London he was appointed Chief Assistant Engineer at the Vauxhall gasworks. In 1910 Mr. Head was put in full charge of the mains department of the South Metropolitan Gas Company. During the 1914-1918 war, he had charge of the old West Greenwich gasworks at Deptford Creek, also serving for the Ministry of Munitions as District Manager of the Metropolitan Munitions Committee. Later he was Director of Works of the Munitions Inventions Department, finally working in the Gas Supply Department, investigating causes of short supplies and consumers' complaints. Gasworks priorities were also under his control. In 1920 he joined Humphreys & Glasgow Ltd. For some years Mr. Head was a Director of the Northfleet and Greenhithe Gas Company—until the South Suburban Gas Company took over. The Head family has continuously served the gas industry since about 1840 both in the executive and engineering fields, giving a total service of about 300 years.

MR. C. J. B. SAWBRIDGE has been appointed Chief Accountant of the South Eastern Gas Board in succession to the late Mr. C. Stredwick. Mr. Sawbridge was educated at King Edward VI School, Norwich, and Eton College. In 1924 he was articled to Mr. William Cash, partner in the firm of Cash, Stone & Co., chartered accountants, and became a partner at their Southampton office in 1930. In 1935 he was appointed Chief Clerk and Accountant to the Eastbourne Gas Company, becoming Assistant Secretary in 1938, Secretary in 1946, and General Manager and Secretary in 1947. On nationalisation he was appointed Accountant to the Sussex Division of the South Eastern Gas Board. In August, 1955, he was made Assistant to the Board's Chief Accountant, Mr. Stredwick, and became Deputy Chief Accountant in April, 1956. In March, 1939, he joined the 70th (Sussex) Searchlight Regiment, R.A., Territorial Army, and was commissioned in December of that year. He served as staff lieutenant, 27 A.A. Brigade, 1942-43, was given a staff appointment at the War Office in the rank of captain in 1943, and was later promoted to major. Mr. Sawbridge is a Member of the Office Management Association, an Associate of the Institution of Gas Engineers and a Member of the South Eastern Society of Chartered Accountants.

MR. A. G. D. COLLIS, who is Education and Welfare Officer, East Midlands Gas Board, is to be redesignated Education and Training Officer.

MR. M. LYTH has been appointed Production Manager of the Lincoln Electric Co., Ltd., Welwyn Garden City, Herts. Mr. Lyth was formerly a management consultant with Production Engineering Ltd.

MR. FRANK ROWE, has been appointed a Director of the George Cohen 600 Group Ltd., the holding company which controls the 600 Group. Since 1943, Mr. Rowe has been Managing Director of one of the largest companies in the 600 Group—K. & L. Steelfounders & Engineers Ltd. He will continue to hold this position. Mr. Rowe, who is 58, was educated at Manchester grammar school and, before going to Manchester University to read Metallurgy, served three years' apprenticeship on the foundry floor and in the pattern shops of Metropolitan Vickers. After leaving the University he had varied experience in engineering, and in foundry practice in steel, iron and bronze. Before joining the 600 Group, he was for a number of years a director of David Brown's.

MR. ERNEST SPRINGTHORPE, who was Chief Draughtsman to the late Mr. James Bussey in the Constructional Steelwork Department of Thos. W. Ward Ltd., has been appointed Local Director. Other appointments to Local Director are: MR. C. NORMAN BRADSHAW; MR. ERIC WOLSTENHOLME, who is now assistant to the London Director; MR. GEORGE PAGE, Manager of the Export Department, MR. REG. HADFIELD, Manager of the foundry supplies and refractories side of the business; and MR. ALFRED KISSACK of the machine tool section. The new Local Directors have all spent their entire business life with the Company.

MR. A. BELL has been appointed Sales and Service Manager, Sussex Division, South Eastern Gas Board. Mr. Bell received his early training at Penistone in Yorkshire, and after spending 6½ years in Kent, became Sales and Service Superintendent of the Exeter Company in 1933, at a time of considerable reorganisation and expansion. He was appointed Distribution and Sales Superintendent at Rochester in 1946 and later Manager of the Medway District, Kent County. Mr. Bell was President of the Western Junior Gas Association from 1939 to 1944, and for some time a member of the Council of the London and Southern Junior Gas Association.

MR. E. D. WHITELOCK and MR. R. W. L. RAMSDEN have retired from the Board of Brotherton & Co., Ltd. Mr. Whitelock joined the Company in 1913 as Chief Engineer and became a Director in 1943. Mr. Ramsden joined the Company as Works Engineer at the Birmingham works in 1915, was later appointed Manager there and became a Director in 1953. MR. C. L. EVANS has joined the Board as Director in charge of Production.

MR. H. S. MALIK, C.I.E., O.B.E., Grand Officier de la Légion d'Honneur, lately Indian Ambassador to France, has been appointed Special Director (India) of Simon-Carves Ltd., who have important interests in India and maintain a permanent staff there. Mr. Malik will be resident in Delhi, where he arrives early in January.

BRITAIN'S BIGGEST COKING PLANT

New Dorman Long Plant Can Be Doubled In Size

THE first half of the ovens of the complete new coke oven and by-product plant built by Simon-Carves, Ltd., for Dorman Long (Steel), Ltd., at South Bank, Middlesbrough, is now in operation. The second half is expected to go into service early next year.

This plant is the largest coking installation built as a single unit in Britain, and is arranged so that it can be doubled in size. Construction on site was begun by Simon-Carves in February, 1953, and the first block of ovens was ready for heating up in July, 1956, but this had to be postponed until October owing to the restriction of work by maintenance men in the steel industry.

The 150 compound underjet ovens will carbonise 25,000 tons of coal per week. They are arranged in two blocks of 75 ovens on either side of a 5,000-ton coal service bunker.

Coal Handling

Coal is received by rail, discharged by rotary wagon tipplers, and either conveyed to the blending bunkers or discharged on to a 100,000-ton stocking ground, over which it is distributed by bulldozer. Bulldozers are also used for reclaiming the coal to hoppers feeding an underground reclaiming conveyor. The present capacity of the coal handling plant is 310 tons per hour.

The coke handling system includes primary and secondary screening plants, from which graded coke can be conveyed to the blast furnace bunkers or to loading points for rail and road wagons. 'Foreign' coke can also be received, handled and screened.

By-products

The by-product plant handles all the gas output of the ovens and incorporates the indirect system of ammonia recovery. This plant, like the coal and coke handling systems, is arranged so that it can be extended to serve a future coke oven battery.

Ram-side view of the South Bank battery, taken shortly before commissioning. The ovens now in service are those on the right of the bunker.

New Careers Pamphlet

The Institution of Chemical Engineers, 16, Belgrave Square, London, S.W.1, has issued a new pamphlet on chemical engineering as a career. This has been designed for the senior pupil who is seriously considering what he or she will do on leaving school. Complimentary copies are available.

Coal and Labour Costs Push Up Coleraine Gas Price

COLERAINE and Portstewart (Northern Ireland) gas is to go up by 2s. 1d. a 1,000 cu.ft. to offset increased coal and labour costs since June, 1955, when the last rise in price took place.

The increase is also required to abate a trading loss which has accumulated over the past five years.

The undertaking's Manager, Mr. T. R. Cameron, and the Coleraine Borough Council's accountants examined the financial position and found that to wipe out the trading loss over a period of five years, an increase of 3s. 1d. a 1,000 cu.ft. would be required.

Increased Residuals

Although this was agreed to by the Ministry of Commerce, the undertaking raised the price by 2s. 1d., making the cost of gas 10s. 10d. to 9s. 3d. a 1,000 cu.ft. in Coleraine. Extra revenue to cover the difference is expected from an increased yield of residuals.

The new prices mean that since 1938 the price of gas has advanced by 189% while the cost of coal has advanced 336%.

Efficiency Test

On the recommendation of Mr. Cameron, it has been agreed that there should be a full-scale efficiency test at the Coleraine gasworks. The National Industrial Fuel Efficiency Service will carry out the test, which will last a week.

MOVE TO LINK DIVIDENDS WITH PRICES FAILS

WHEN the motion for the approval of the Waterford Gas Order came before the Eire Senate, Dr. Owen Sheehy Skeffington moved amendments to insert a new paragraph setting out that the standard price of gas be 3s. per therm, and that all dividends be permitted to rise or fall from the rate of 6½% at the rate of ⅛% for every ⅛d. per therm below or above the standard rate.

This linking of the dividend with the price of gas, which was not a new thing, he said, would act as an incentive to reduce the price as the best method of gaining the right to raise dividends.

Mr. Grotty, Parliamentary Secretary to the Minister for Industry and Commerce, said the purpose of the Bill was to enable the Company to raise the money to extend its enterprise.

Dr. Sheehy Skeffington's amendments were defeated without a division and the original motion was passed.

W-D Chairman Ends Four Months' Tour

AUSTRALIAN—N.Z. EXPANSION TALKS

MR. T. C. FINLAYSON, Chairman of Woodall-Duckham Ltd., and of Woodall-Duckham Construction Co., Ltd., arrived back in England on December 21 after a four months' trip to Australia and New Zealand. Mr. Finlayson made his visit in connection with the activities of the Australian subsidiary, Woodall-Duckham (Australasia) Pty. Ltd.

His itinerary included Melbourne, Adelaide, Sydney, Auckland, Wellington and Christchurch. Mr. Finlayson discussed with the Australian Board and with leaders of the gas industry in Australia and New Zealand the steps necessary to expand the Australian company to meet the changing industrial needs of those countries.

He attended, with Mrs. Finlayson, the annual convention of the Australian Gas Institute at Sydney at which he represented the Institution of Gas Engineers.

Mr. Finlayson inspected the new works built by Woodall-Duckham (Australasia) Pty. Ltd., at French's Forest (N.S.W.) to increase the supply of refractory materials, and visited the Lurgi plant at Morwell just after it went to work.

Long Service Awards

At the annual Christmas dinner of Clapham Brothers Ltd., gas plant makers of Wellington Works, Keighley, Mr. T. Alborn Clapham, Chairman and Managing Director, presented gold watches to eight long service employees.

Four of them are still working—Mr. Percy Buck with 50 years' service, Mr. Edward Walmsley 48 years', Mr. Harry Nicholson, 43 years', and Mr. James Petyt 42 years' service. The four others have retired and are Mr. Richard Moffitt 43 years' service, Mr. Thomas Pearson 40 years', Mr. Menzies Ramage, 42 years' and Mr. William Milson 41 years'.

Two employees of the Keyham (Devonport) station of the South Western Gas Board were presented with long-service certificates and cheques by the Station Engineer, Mr. P. G. Richardson, and the chairman of the works benevolent club, Mr. J. Luce on December 22.

They were: Mr. C. Lake, of St. Budeaux, Plymouth, who has served 36 years, and Mr. H. Edge, of Keyham, Plymouth, 41 years. Both are now aged 65, and are retiring.

Mr. P. W. Betts, Chief Clerk in the Commercial Manager's Department, Watford Division of the Eastern Gas Board, receiving a national scholastic award from the Mayor of Watford, Councillor A. Abbott. Mr. Betts was awarded the Sir Joseph Burn Prize for the best papers produced in the Office Management Association's final diploma examination for 1956. He received 10 guineas and a commemorative certificate. Pictured are (left to right): Mr. E. T. Warren, Watford Division Secretary and Accountant (Mr. Betts' sponsor for the examination); Councillor Abbott; Mr. G. M. Guthrie, Vice-president of O.M.A.; Mr. Betts; and Mr. J. L. Cousins, Secretary of the Association.

Minister Must Give Reasons For Decision, Say Councils

WARWICKSHIRE County Council and Meriden Rural District Council are pressing the Minister of Fuel and Power to reveal the reasons for his decision concerning the first public inquiry into the proposed £4½ mill. gasification plant at Coleshill.

After the first inquiry two months ago, the Minister decided that half the land needed for the plant—the first of its kind proposed in the country—was 'operational' under the Town and Country Planning Act 1947, which left neither the Councils nor the Gas Board with a clear advantage.

Until they know the reasons for the decision, the Councils are unable to prepare their case to oppose the project at the second inquiry, which has been provisionally arranged for February 21 and 22.

A Meriden Council official said on December 28: 'Counsel has advised us to seek the reasons from the Ministry. To give a decision without them is contrary to all principles of law.

'We must know what the reasons are, otherwise we cannot build our next case,' he added. 'If they are not forthcoming we expect counsel to advise further action before the second inquiry can be held.'

Planning permission for the plant was refused 12 months ago by Meriden Council, on behalf of the County Council.

CHANGE OF ADDRESS

Mr. M. V. Jackson, Technical Representative of the Incandescent Group, has recently changed his address and now resides at:—'Hadfield House,' Eccleshall Road South, Sheffield, 11. Telephone: Sheffield 65927.

Mr. Jackson is available to deal with enquiries concerning fuel fired and electrically heated furnace equipment, and will continue to be of service to users of such plant. The companies which he represents are: The Incandescent Heat Co., Ltd.; Metalectric Furnaces Ltd.; Controlled Heat & Air Ltd.; Selas Gas & Engineering Co., Ltd.

Company News

COLONIAL GAS HOLDINGS

Colonial Gas Holdings Ltd., who made a net profit of £175,340 for the year ended June 30, 1956, have declared 3% final dividend on the cumulative preferred stock, making 6% for the year, and a final dividend of 4% on the ordinary stock.

Increase in gas sales over all undertakings was 6.2%.

POWELL DUFFRYN LTD.

The Directors of Powell Duffryn Ltd., have declared an interim dividend of 6% actual, less tax, on the 9,660,471 ordinary shares of 10s. each in respect of the year ending March 31, 1957.

Yorkshire Copper Works Ltd., Leeds.—Final dividend of 6% (less tax) together with bonus of 3% (less tax) in respect of year ended July 31, 1956, recommended on ordinary stock, making a total distribution of 15% (12%). Net profit for the year amounted to £643,782.

Civil Engineers Discuss N.C.B. Developments

OF the £128 mill. which have been spent on 179 major schemes planned by the National Coal Board all but £11½ mill. is still in the 'pipeline.' This fact was disclosed recently at the Institution of Civil Engineers, when the paper 'Post-War Developments in the Coal Mining Industry,' by Mr. A. Young, Chief Civil Engineer of the National Coal Board, Mr. H. A. Longden, Director-General of Production, N.C.B., and Mr. B. L. Metcalf, Chief Engineer, N.C.B., came under discussion.

The Coal Board's aim is to reach a yearly output of 240 mill. tons by 1960 against the present 215 mill. tons, and they described some of the new techniques in construction and renovation now being employed in the industry, and told how 3,000 miles of tunnel will have to be constructed in the next 15 years.

In the past 10 years more had been learnt about the coal reserves of Britain than in the past century, and they stressed the importance of accurate knowledge before starting on mining projects which might well cost as much as £8 or £10 mill. before any coal is drawn.

Among recent developments is a seaboring tower now at work in the Firth of Forth. There is also a new technique in sinking mine shafts through water-bearing strata, whereby the water is frozen while a waterproof concrete lining is built. The use of concrete for this purpose is new and cheaper than the former linings of brickwork and cast-iron segments. Experimental work has also been done on transporting coal by water in a pipeline.

Scope for Automation

Referring to the possibility of full automation in the coal mines, they said: 'The scope for automation in the sense of having machines to carry out work on materials seems to be confined to the coal-cutting and loading, possibly to a moving-prop system, and to the separation of dirt from coal.'

There are still however many aspects of work at the coal-face which call for engineering judgments which at the moment cannot be supplied by robot methods.

Even should all go according to plan the mines will only be producing 250 mill. tons of coal annually by 1980 which will leave a gap in requirements of between 90 and 100 mill. tons which will have to be filled by oil, nuclear, or other means. In 1913 British coal mines were producing annually 287 mill. tons.

VICTIMS OF GAS POISONING SHOW FURTHER RISE

SIR John Charles, Chief Medical Officer of the Ministry of Health, states in his annual report for 1955 that the number of deaths from coal gas poisoning has continued to increase and, once again, the increase is mainly shown in the aged.

Sir John states: 'There has been an increase in the fatality rate per therm of gas sold and an increase in the number of fatalities per million consumers.

'About three-quarters of these fatal accidents are due to gas taps being left on, usually the cooker, oven, hotplate, or portable boiling ring.'

Figures given in Sir John's report show that for people from 65 to 74 years of age the fatality rate per million has risen from 21 males and 32 females in 1951 to 41 and 37, respectively, in 1954.

The figures for 75-year-olds and over have shot up from 99 and 142 in 1951 to 146 and 159 in 1954.

'It is realised that many of these fatalities occur in old people because of their diminishing sense of smell and hearing,' Sir John writes.

'In order to draw attention to these obvious risks to old people, a technical sub-committee of the Gas Council's Watson House Research Centre has included a home safety representative and is enlisting the help of the various social organisations concerned with the problems of old age.'

N.T.G.C.C. & BOARD ON SATISFACTORY, FRIENDLY RELATIONS

SATISFACTORY and friendly relations with the Board have continued and on no occasion has there been any reluctance on the part of the Board to supply information desired by the Council, states the report for the year ended March, 1956, of the North Thames Gas Consultative Council.

The fact that the Chairman of the Council attends the monthly meetings of the Board's Commercial Committee, which deals more particularly with consumer relations and gas sales and service, is naturally of great assistance to the Council in putting its point of view at Board level, adds the report.

Seventy complaints or representations were received and dealt with during the year, exclusive of large numbers of complaints of a minor nature received by members of district committees and settled at local office level.

The 70 complaints and representations were made up as follows: Price of gas, two; disputed gas accounts, 11; other disputed charges, 14; low pressure, one; criticism of Board's policy and service, 12; delays—delivery and repair of gas appliances, two; defective gas appliances, six; setting of prepayment check meters, three; meter rents, three; coke quality and deliveries, eight; public lighting, one; showrooms—hours of business, one; ownership of appliances, one; and miscellaneous, five.

I.G.E. Northern Section Holds Joint Meeting with Juniors

THE Institution of Gas Engineers, Northern Section, held a general meeting jointly with the Northern Junior Gas Association in the demonstration theatre of the gas showrooms, Darlington, Yorks, recently. Members were welcomed by Mr. F. Wilson, General Manager, Darlington Division, Northern Gas Board.

The Chairman, Mr. J. R. Cleator, on behalf of the members of the Northern Section, expressed a warm welcome to the President, Mr. J. C. Graham, and members of the Northern Junior Gas Association, and also to Mr. J. E. White, Deputy Chairman, Northern Gas Board.

Mr. F. C. Brothwell, formerly on the staff of the Darlington Division, and now with Whessoe Ltd., of Darlington, was presented with the I.G.E. Associate Membership Certificate in Gas Engineering (Manufacture) by the Chairman.

A paper, 'Some Technical Aspects of the Gas Industry,' was then read by the author, Mr. W. R. Garrett, Construction Engineer to the Northern Gas Board. In the discussion which followed questions were asked on the use of prepayment and domestic meters, the apparent wasteful use of natural gas, the use of gas from coke oven plants, the accident rate, the high oxygen content of gas and heavy corrosion, the value of works pretreatment of gas, methods of controlling calorific value, and provisions made in case of breakdown of natural gas supplies.

A vote of thanks to Mr. Garrett was proposed by Mr. J. R. Cleator, and appreciation of the hospitality provided was expressed by Mr. J. C. Graham to Mr. F. Wilson and the Darlington Division of the Northern Gas Board.

Mr. Graham, as President of the Northern Junior Gas Association, also responded to the welcome given by Mr. Cleator and thanked him for the invitation to attend the meeting of the Northern Section.

WHITHER ELECTRICITY?

THE FIRST OF A NEW SERIES OF ARTICLES BY

'Thermopile'

MOST business men in the gas industry today are taking an increasing interest in the activities of the electricity supply industry. This interest has swung almost from one extreme to the other over the past 40 years, from a refusal to face facts on the one hand to an anxiety which may almost seem to be overdone to-day.

That the gas industry is concerned is obvious from a study of the gas Press. Nearly every report of meetings of managerial or commercial men in the gas industry has its inevitable reference to electricity, and the competition from it which has to be met. To anyone completely outside the fuel industries it might appear from a study of both gas and electrical trade journals that the gas industry really had cause to be concerned, particularly in view of the fact, that, in comparison, references to gas in the electrical papers were much fewer.

Is there cause for concern? If so what is the electric supply industry really doing which may affect the gas industry, and what are its plans, if any, for the future?

Those who know anything of the inner working of the electrical industry are aware that it is fully occupied with its own problems of planning to meet future demands. Commercial development is on a large scale but not so very much larger than commercial development in the gas industry. It has, however, to cover a much wider field than gas, selling appliances for lighting and power and domestic devices like cleaners and small portable gadgets which are exclusively electrical and do not compete with any other industry. Its selling effort on competitive lines, however, may be less than that of the gas industry.

Results of the Herbert Report

What prospects will 1957 bring to the electrical supply industry? First, of course, the re-organisation which will follow the new legislation based on the Herbert Report, shortly to be introduced in Parliament.

It is said that the proposed new set-up will follow more closely the lines of the organisation of the gas industry. If this is to be the case the electrical supply industry may stand to benefit, as the gas industry certainly avoided some of the mistakes which electricity made when it was nationalised.

The new Electricity Bill will take the production of electricity out of the hands of the Central Authority and hand it over to a separate body which will have nothing to do but to turn out the stuff as cheaply as possible to sell in bulk to the area boards. The new Electricity Council will apparently be similar to the Gas Council, in its co-ordinating powers, at least, though whether it will indulge in publicity and load development activities remains to be seen.

EDITOR'S NOTE

'Thermopile' cloaks the identity of a well-known figure in the electricity industry whose views on the development of his industry and its future relationship with the gas industry will, we believe, be of great interest to 'GAS JOURNAL' readers. This article, which deals with the implications of the new Electricity Bill, is by way of introduction; in subsequent articles the writer will cover load development trends in the industrial, commercial and domestic spheres.

Another proposal in the Bill is to give powers to the area boards to generate electricity themselves, if they can put up a good case for doing so. Whether this would also permit them to purchase surplus electricity from a gasworks power station is not mentioned. One can envisage the possibility of an area board obtaining powers to construct a power station which can be combined with a local district heating scheme and sell its waste heat to good effect. District heating is in fact mentioned in the Bill.

This is something of which little has been heard before in Parliamentary recommendations but it is obviously the result of the present urge to make better use of the nation's fuel. For many years the electrical industry has excused its low thermal efficiency of production behind the plea that no other public utility could supply heat on tap to the community at a higher efficiency from the low grades of fuel it uses. This excuse may no longer be valid when the gas industry commences to carbonise lower grades of coal; indeed this could be said to have already started.

Heat Wastage Inexcusable

Apart from this aspect of fuel utilisation any waste of heat is inexcusable and if, during the coming years, production of electricity reaches the extent that the C.E.A. forecasts, the amount of waste heat rejected in cooling water will reach a colossal amount. Whether electricity is generated from coal or from nuclear fuel this waste cannot go on. District heating from new power stations is apparently envisaged by the Government, but how it will be developed and the capital it will require to distribute it has not yet been considered.

The use of off-peak electricity for heating—as recommended in the Beaver report—has made a little headway during 1956 and its development in the form of floor heating in blocks of flats and commercial premises has already produced encouraging results. Naturally there are teething troubles to be overcome, but it looks as if a number of area electricity boards have taken up the idea with enthusiasm.

So far the price of off-peak electricity since nationalisation has not enjoyed the same differential it enjoyed before the war. In 1939 'night tariff' electricity was usually half the price of the ordinary two-part tariff unit rate. Today it is roughly seven-eighths. The reason for this is that before the war electricity undertakings owning their own power stations could sell night tariff electricity at a little above coal cost, as all overhead charges for generation and distribution were already covered. Today any reduction in cost which can be given during night hours comes from the elimination of capital charges on distribution only, as the area boards still pay the C.E.A. the same price for every kilowatt-hour purchased whatever the time of the day. Whether the difference in cost to the consumer between night and day use of current will ever reach the same ratio as it did before the war is open to conjecture as conditions are now somewhat different.

The electricity supply industry appears to be determined to pick up whatever domestic load it can. Some would say that it wilfully neglects the industrial load. It is true that Britain uses far less H.P. per worker than the U.S.A. but it is argued that increased motorisation of plant could only be justified if industry worked more than one shift. While one must admit that there isn't the labour available today for any considerable adoption of two-shift, let alone three-shift working, it seems that the eventual growth of automation must inevitably bring longer factory hours in order to make it worth while.

Until that day dawns the industrial load will remain a five-day/eight-hour business with its inevitable early morning peaks and sharp drops in load at tea-time. The domestic load fits in nicely with it and lasts over the week-end as well, and this is the argument the electrical supply industry puts forward for its development.

Three Commercial Atomic Stations were the subject of an editorial note on p. 24 of last week's issue. In stating that the General Electric Company have been given a contract for the new station at Hunterston, Ayrshire, we should have pointed out that although the G.E.C. are the main contractors the station has been designed by the G.E.C. Simon-Carves Atomic Energy Group and will be built by the joint efforts of its members.

Gas Cooling and Tar Fog Removal

By E. G. STEWART, M.Inst.Gas E., M.Inst.F.

KING'S MANUAL OF GAS MANUFACTURE, SECTION 7A. BY CHARLES COOPER AND JAMES J. PRIESTLEY

(Octavo, 106 pp, 26 illustrations, mostly in line, price 14s. 8d. Walter King, Ltd., 11, Bolt Court, Fleet Street, London, E.C.4.)

IN the first 100 years of its existence the growing gas industry was well served with nearly a dozen comprehensive textbooks, several of which ran to a number of revised editions. In the last 40 years far-reaching changes have arisen in processes, plant, and methods, yet for most of the period the entrant into gas engineering has been handicapped by the absence of any up-to-date 'Compleat Gas Engineer.'

During his Presidency of the Institution in 1941-42, Sir Frederick West suggested to Walter King, Ltd., that a gap existed to be filled, and that the house which produced 'King's Treatise' a hundred years ago might provide a worthy successor to those famous volumes. Thus, after the war, 'King's Manual' began to appear—first as one of two projected volumes, then in parts; the latter to facilitate revision and ease the burden on the student's pocket.

Of the eleven sections that have been so far envisaged eight have now been published. The latest is 7A dealing with gas cooling and tar fog removal. The joint authors, Mr. Charles Cooper and Mr. J. J. Priestley, need no introduction to the gas industry on account of their work with W. C. Holmes and their many valuable contributions to the literature of the industry.

Primary Essentials

Gas cooling and tar removal have been the primary essentials of gas purification from the earliest days of an extended foul main and a breeze box to the elaboration of modern arrangements. The earlier textbooks covered the subject with copious illustrations of apparatus, most of which had been designed by individual and inventive gasworks engineers and developed by foresighted contracting firms. Our predecessors, however, had the easy task. So long as gas manufacture was confined to horizontal and inclined retorts there was only 15,000 B.Th.U. to be extracted from each 1,000 cu.ft. of gas. With our newer methods this has grown to some 30,000 with continuous vertical retorts and horizontals with scrubber standpipes, to 40,000 with coke ovens and intermittent verticals and to nearly 60,000 with the various gasification processes.

Simultaneously, but especially in recent years, capital costs and water charges have risen rapidly. Works are becoming larger, ground space gets more valuable, and increased efficiency at the lowest cost is more and more essential.

From about 1930 the processes of the industry, even the most simple, developed over a long period of time on experimental and empirical bases, have been re-examined in the light of the fruits of chemical research. New and sometimes more accurate means of design and operation have resulted.

Recently the Annual Research Meeting of the Institution received yet another communication dealing with heat and mass transfer coefficients in gasworks plant design. The appearance of this treatise, based on the latest knowledge, is most timely. The treatise is divided into ten chapters, of which seven are devoted to gas cooling and three to tar fog removal.

The first chapter, after a review of the impurities to be removed in the two processes, proceeds to a sub-section wherein the theoretical aspects of heat exchange and the theories of mass transfer are elucidated.

In the next chapter these considerations are taken a stage further and the basic theories are reconciled with the problems of cooling and condensation in respect of spray cooling, water and air cooling. The latter aspect, though diminishing in use, is not neglected but no reference is made to recent developments in America of forced draught atmospheric condensers.

The third chapter brings the logical development of the subject to the practical problems of water-cooled condensers and washer coolers. This chapter ends with a sub-section in which the method of ascertaining efficient condenser design from mass transfer methods is explained with the aid of a fully worked out example. Cooper's own method is employed, but the working is later used to explain the proposals of other workers in this field, viz., Colburn and Hagen, Bureau, and Silver. For those who need more detailed information on these other methods, full references to their publications are included.

The fourth chapter considers the question of two-stage condensation which is viewed from the angles of naphthalene deposition, water supply quantity and temperature, etc. The discussion then leads to the means of providing suitable water for cooling, the physics of water cooling, and finally to the recovery of heat for boiler feed warming.

The authors consider the prospect of siting gasworks, where adequate supplies of water for cooling and coke quenching can be obtained from natural supplies, to be extremely remote. Have they overlooked the fact that nearly one-fifth of the manufacturing plant of the entire industry (about 480 mill. cu.ft. per day) does in fact get a substantial proportion of such needs from the Thames and its associated waterways?

For the situations that are not so well placed, the authors devote a whole chapter to the consideration of suitable water supplies. A typical 7 mill. cu.ft. per day works, equipped with intermittent vertical retorts, is taken and various combinations of demands are examined together with the adoption of natural draught and forced draught water coolers, as well as the use of a severely limited amount of cold well water.

The logical layout of these five chapters in clear language is noteworthy. With the exception of temperatures all measurements are expressed in British Units (cu.ft., gallon, B.Th.U., etc.), but for temperatures Centigrade and Fahrenheit degrees are used indiscriminately, so that the reader has frequently to pause and mentally convert.

In chapter 6, ten well-known, but unidentified, designs of condensers are critically and fairly examined with the aid of simple sketches. The succeeding chapter introduces further features common to all designs, such as the avoidance of air pockets, cleaning the gas side of the tubes, dissolved air and tube corrosion. The proper provision of spare condensers is also discussed. In this section the authors state that it is doubtful whether the use of chlorine to inhibit algae growth in natural waters is cheap enough for large-scale application. Surely this is a misconception. This form of treatment should not cost more than 6s. per mill. gal.

Costs of Condensers

The chapter concludes with an examination of the relative capital and other costs of condensers of normal and high performance design. As the authors so rightly point out, such an analysis is of the type the student should be prepared to apply in practice. Unfortunately their own conclusions lack the clarity found elsewhere in the treatise. Neither will the student, in the absence of some further data, be able to reach a proper consideration. Such information as is needed to comprehend various practical condenser problems includes:—

1. Typical data of the heat and water vapour content of the crude gases from all the established systems of gas manufacture.

2. Data relating the water flow demands of condensers to varying surface area and operating at various inlet gas temperatures.

3. Data comparing the capital charges of normal and higher performance condensers with their respective water costs including pumping, and gas pumping expense, at varying costs for water.

Armed with this information and the matter in this treatise

any gas cooling problem could be solved or understood. In its absence the work is not quite complete in itself.

On the subject of high performance coolers the authors have, a few pages earlier, expressed a definite opinion:—

'Hence we may conclude that since we have to accept the inevitable fouling of both the gas and water sides the simpler and more robust and more generous design will offer more uniform service than the alternative which provides a better performance per unit of tube surface.'

They may well be right, but surely in a text book one should expect to find as much factual data as is required on which to base an individual examination of all sorts of operating conditions.

The final third of the treatise is devoted to tar fog removal. Chapter 8 examines the requirements and the basic methods on a fundamental basis. Chapter 9 is devoted to an examination of all the well-known mechanical methods of removal including the use of turbo exhausters, fan extractors, cyclones, Livesey washers and two forms of P. & A. extractors.

The last chapter in the treatise examines in considerable detail the principles of, the design, construction and operation of electrostatic detarrers. The differing applications of this process to carburetted water gas, producer gas, and hot gas detarring are also explained. No mention is made of the construction of the rectifiers which is a pity as to many students they are a box of mystery. A paragraph is devoted to the need for interlocking switches as safety precautions but the potential hazards of this valuable piece of plant could well have been more fully explained and stressed. A reference in this paragraph to the (Safety Rules) Committee of the I.G.E. appeared on first reading to refer to the Rules for the Safe Operation of Electro-detarrers—these were of course published some six years ago. One would have liked to have seen them mentioned here. The reference however seems to concern work on a means of preventing ignition of an approaching explosive condition by automatic switching off of the apparatus. Such a device has been on trial operation for several years and, it is understood, will shortly be marketed.

The last two and a half pages of the treatise are occupied by standard data concerning the properties of the common gases and of typical purified fuel gases. None of the information in these tables is directly associated with the subject of the work and the space could be better utilised with tables and charts giving the information mentioned earlier.

The whole work is a much needed and most creditable addition to the previous sections of King's Manual and one which should be of great assistance to the student. It seems to be entirely free from errors or misprints.

From a paper presented to the 22nd Autumn Research Meeting of The Institution of Gas Engineers in London

Heat and Mass Transfer Co-efficients in Gasworks Plant Design

By G. S. CRIBB, M.A., D.I.C., A.M.I.Chem.E.
LONDON RESEARCH STATION, THE GAS COUNCIL,

and

E. T. NELSON, B.Sc., A.M.Inst.F.
LONDON RESEARCH STATION, THE GAS COUNCIL.

THIS paper is in effect the outcome of three separate investigations: An enquiry into the transport properties of gas mixtures in general, for estimating heat and mass transfer coefficients and pressure drop from known correlations; the derivation of a design method for simultaneous mass and heat transfer, which would overcome the limitation of existing methods; and the determination of the relative rates of heat and mass transfer between water vapour and coal gas in a wetted-wall column.

This determination of the relative transfer rates should have preceded the derivation of the design method. It was, in fact, carried out afterwards, as a result of the apparent discrepancy between (a) the observed value for the ratio in the calibration of the G.L.C.C. wet and dry bulb hygrometer and (b) the value calculated for the ratio from relationships since proved to be incorrect for hydrogen mixtures.

The current interest in the problems investigated is apparent from the number of articles appearing in the literature recently. Two such papers have been published in the *Petroleum Refiner* since this paper was prepared. The first, by Rubin, entitled 'Finding the Properties of Hydrogen Mixtures," is similar to Part III of this paper in that it is based on the work of Hirschfelder on tranport properties and the methods of Wilks for gas mixtures.

Although the published work of Hirschfelder is highly mathematical, if one is prepared to accept that the Lennard Jones 6-12 potential is a reasonable representation of the intersection between non-polar molecules, then the resulting collision integrals may be used with confidence. Many of you are, no doubt, more familiar with the empirical equations of state used to explain gas imperfection, such as the Van der Waal equation. The concept is similar, but the parameters of the Lennard Jones 6-12 potential are more fundamental and have a far wider application than the Van der Waal constants.

The limitations must be borne in mind, however. Hydrogen cyanide, for example, is a polar molecule and exhibits a viscosity relationship which is anomalous, and the method outlined cannot be used to assign force constants to the gas for the 6-12 potential.

The second article in the June issue of the *Petroleum Refiner* by Bras is entitled 'How to Design Cooler-condensers.' The author points out that for general design purposes, methods which assume a Lewis number of unity and/or humidity driving force, are not applicable. He proposes a graphical method based on point to point calculation of the total heat transfer coefficient in the gas phase. As with many other such methods it cannot be used in reverse to obtain coefficients from test data. Furthermore, partial pressure is considered to be the driving force for mass transfer, and this leaves one with the awkward factor, termed the long mean partial of the non-diffusing gas, which has to be calculated by trial and error at each stage.

In the gas industry we have to deal with a hydrogen rich mixture. It will be appreciated from the paper that the computation of the properties of such a mixture is laborious, but this is offset by the fact that for engineering purposes

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a measure of importance –

Huang Ti, a Chinese Emperor, according to legend, led his troops to victory by 'South Pointing' Chariots, which pointed south irrespective of the chariot direction.

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we may assume a fixed composition. Thus once the properties of such a system have been calculated they may be used in a wide variety of problems. This fact combined with the fact that cooling and condensing is carried out at substantially atmospheric pressure enabled a design method to be developed for coal gas, in which the properties of the gas are combined into a single potential for total heat transfer.

As neither humidity nor partial pressure is the true driving force for mass transfer, there is no point in using either in preference to the driving force resulting from the integration of the differential equation for diffusion. The re-arrangement of the integrated form of this equation to obtain partial pressure difference of the diffusing gas was a mathematical device to give a term which approximated to unity for dilute mixtures. It was, we are sure, never intended for application to systems where the concentration of the diffusing gas exceeds that of the non-diffusing gas. We would like to stress this aspect of the design method as we believe it represents a significant advance.

Expressing the total heat transfer as a function of the mass transfer coefficient enables the determined coefficients for cooler-condensers and washer-coolers to be compared with those obtained in cooling towers, gas drying plants and even ammonia washers. Ammonia and water vapour are similar as regards molecular weight and force constants and therefore diffuse at about the same rate.

With regard to the peformance tests on the condensing system of the carburetted water gas plant, further tests on the combined feed water heater and primary condenser and four tests on the secondary condensers have now been analysed. The other two tests on the primary condensers confirm the results of the first test under normal load, there being three values for the coefficient; one value for the last three gas bays and two values for the first bay depending on the quantity of cooling water circulating. The four tests on the secondary condenser varied only with respect to inlet temperature. Values of k_g agreed within 3%, whereas the variation in the values of h_s was about 14%. Another interesting fact is that the h_s values indicated a safety margin of 52%, whereas the margin indicated by the k_g values was only 23%.

Finally, we would like to draw attention to the significance of the results for wetted-wall column. These confirmed that the Lewis number is substantially greater than unity, and this combined with the fact that the driving force for mass transfer is less than the humidity difference means that the relative rates of heat and mass transfer are such that gas tends to become supersaturated on cooling. In other words, in gas that is saturated or nearly saturated the rate at which water vapour condenses is in excess of that at which it can diffuse through the gas into the condensate film. As a result it remains in the form of small droplets in the main body of the gas, that is, a fog is formed. It would be interesting to know whether this has in fact been widely observed in condensing systems.

Mr. Cribb had prefaced his remarks with a reference to certain errors appearing in his printed paper.*

DISCUSSION

In the discussion which followed **Dr. J. C. McCoubrey** (Imperial College of Science and Technology) said the work which Hirschfelder had done, and which was worthy of being more widely publicised, was generally applicable when molecules such as carbon monoxide obeyed the Lennard Jones 6-12 potential; the authors had chosen a gas in which the molecules accurately obeyed these principles. In applying these methods to other gases it was wise to look at one or two of the necessary points.

The molecules which were considered in this system were reasonably spherically symmetrical, so they did in fact conform to the 6-12 potential. If one had hydrocarbon mixtures these fundamental principles would not necessarily apply, so that in the treatment of multi-component systems, where components such as ethane, propane or hydrocarbons were present, this application would be considerably more difficult.

In considering thermal conductivity it was necessary to remember that the molecules to which one applied these principles must have comparatively small internal energy and not a great deal of vibrational energy. When you had large molecules which contained considerable quantities of internal energy and were no longer spherical, then these principles would tend to break down.

One possible explanation of the discrepancy in the diffusivity results for viscosity and thermal conductivity lay in the fact that there were certain discrepancies of a molecular nature of interaction between hydrogen molecules and large molecules such as benzene or water vapour.

If one bore in mind the reservations of a molecular nature of the Lennard-Jones potential, it was a most valuable tool, and the method of Hirschfelder could be applied with great profit to a wide number of gas mixtures.

Mr. T. J. Norris (Gas Council Research Student) said the use of psychometric charts provided a neat method for designing cooling towers, etc., due to the fortuitous relationship of the Lewis number being unity, but this method could only be used up to about 100°F. The authors had enabled a similar method to be applied at much higher temperatures and humidities to a problem of the gas industry.

As the molar specific heats of water vapour and town gas were 8 and 7.7 B.Th.U. per lb. mol. respectively, the specific heat of the mixture C would be practically constant for any humidity. He wished to ask the authors whether cases could be solved by this method when the ratio of the specific heats of the condensing and non-condensing components was not unity.

A second question was whether the method could be applied to turbulent flow of gas vapour mixtures. Looking at the examples given by the authors in their various papers, although full data was not available, it appeared that the gas flow was streamline. When larger pressure drops across the condensers could be permitted, higher mass flow rates and the accompanying turbulence resulted in much smaller units; the actual criterion for choice of mass flow rate being an economic balance of power and equipment cost.

They had been doing work on the condensation of steam-air mixtures in turbulent flow and had found that they could predict their experimental results, using a modification of the Colburn and Hougen method. Their proposed modification was to add to the heat and mass transfer through the gas film an amount equal to the cooling of the condensate and then equate this to the total heat transferred through the condensate. Another modification to the Colburn and Hougen method was also necessary for high humidities, for example, steam-air 180-200°F., when the condensate film coefficient was comparable with the gas film coefficient.

He would be interested to hear whether the authors considered that this method could be applied to steam-air mixtures and whether they had done any experimental work on the viscosity of gas-water vapour mixtures.

Mr. J. B. McKean (South Eastern Gas Board) said that from time to time they had had from the Research Laboratories at Fulham a number of excellent papers dealing with the fundamentals of various works processes. The work of Hollings and Silver on the washing of gas, of Silver on gas cooling with aqueous condensation, and of Hutchison and Spivey on the design and performance of cooling towers, had all added considerably to a closer understanding of the basic principles for the design of plant for cooling and absorption processes.

They had advanced considerably from the time when the capacity of condensers was predicted by rule of thumb methods, when the design data for the surface required for a water cooled condenser could be stated as 3-4 sq. ft. per 1,000 cu.ft. of gas made per day, and that for atmospheric condensers as 9 sq. ft. per 1,000 cu.ft., without reference either to the temperature of the gas or to the temperature and the quantity of the water used.

In their present paper the authors had drawn attention to some of the gaps in our knowledge of the physical properties of the complex mixture known as coal gas. Without this fundamental physical data it was not possible to make a rigorous approach to the design of condensers and their critical appreciation of the properties of fuel gas mixtures was most valuable. The reminder, too, that the Prandtl Number of 0.74 which was generally applicable to diatomic gases was somewhat lower for coal gas, was most timely.

* The most significant among these was Equation 7, which, it is presumed, should have read:

$$\phi_{12} = \frac{[1 + (\mu_1/\mu_2)^{1/2} (M_2/M_1)^{1/4}]^2}{4/\sqrt{2}\ [1 + M_1/M_2]^{1/2}}$$

—Ed.

Turning to the authors' comments on design methods for cooler condensers, it was difficult to understand the statements that as the Lewis Number for the system water vapour-coal gas was greater than unity, and as it was incorrect to use humidity as a driving force for mass transfer, that there should be a tendency to fog formation. In a condenser the temperature of the cooling surface was considerably below the dew-point of the gas, and gas cooled by contact with the surface mixed rapidly with hot saturated gas at some distance from the tube wall. Condensation of water vapour from the hot gas was thus effected by this adiabatic mixing, aided by the presence of tar nuclei. The quantity involved might amount to 5-10% of that transferred to the tube wall.

Some years ago a series of tests made on a vertical water tube multipass condenser for the primary cooling of coal gas at one of the works of the South Eastern Gas Board showed that the overall coefficient of total heat transfer was about 40-45 B.Th.U. per hour per sq. ft. per °F. in the gas temperature range of 150-170°F., and about 8 B.Th.U. with the gas about 80°F. The sensible heat transfer coefficients (h_s) for the gas derived from the results using the method of Silver gave average values of 2.9, 2.2 and 1.4 B.Th.U. per hour per sq. ft. per °F. for S.T.P. gas velocities of 11.0, 8.1 and 5.0 ft. per second through the condenser. Values of this coefficient were also obtained for the various passes through the unit, and it was noted that it appeared to have a persistent tendency to be somewhat lower at the hot end. This paper suggested that the data could be re-examined with advantage.

Mr. R. Pollard (R. and J. Dempster Ltd.) said he preferred to be able to form a physical picture of a problem and was reluctant to throw overboard his preconceived and perhaps conservative approach to the solution of the problems presented in the paper. Some years ago he had studied the work of Chilton, Colburn, and Hougen in America and particularly the approach of Colburn and Hougen to the design of cooler condensers. He had thought then—and still thought—that the mental picture engendered by a study of their basic heat balance equation was an easy but accurate concept of the different mechanisms involved in the system now under consideration. In short, he found it easy to appreciate that a weight of water exerting a partial pressure in a carrier gas would want to move to a colder tube surface where the vapour pressure of water was lower, and that the driving force might be represented by the difference in pressure. He did not find it nearly so straightforward to accept the concept of a 'modified enthalpy potential' and a mass transfer coefficient which he could not predict. None the less, his own shortcomings should not be allowed to detract from the quality of this paper which was a most important contribution to their knowledge.

Mr. Pollard then proceeded to examine the paper in considerable detail.

Mr. K. W. Francombe (Whessoe Ltd.) said it was rather difficult to discuss a paper of this type without risk of boring a part of the assembly, and he felt that papers of this nature, which were of somewhat specialised interest, might sometimes better form the subject of a communication to the scientific or technical Press rather than be discussed at a meeting of this sort. However, contributions to the discussion which had already been made rather contradicted this, and perhaps he might be allowed to add a little to what had been said.

Many must have found the physical chemistry and the mathematics in the paper fairly heavy going. But even if they could not always follow the reasoning—let alone criticise it—there were important lessons to be learnt from the authors' conclusions.

They had been reducing the size and cost of cooler condensers during the last 25 years by analysing the overall heat transfer coefficients to determine wherein lay the controlling resistances to heat flow. These had been reduced, normally by increasing the rates of fluid flow on both the shell and tube sides, and such factors had been within their control. But now the precise significance of a further factor had been determined, namely, that of the heavy condensing film at the hot-end of a primary condenser. There was little that could be done about it except to allow for it in calculations, and perhaps to avoid the use of over long tubes unless naphthalene was present. Increasing gas and water velocities evidently had a lesser effect at the hot-end than might have been thought.

However, the value of the paper was more as a tool for analysing performance under various loadings than as a method of control design. Few would employ such a refined approach because a condenser was scarcely worth the overhead expenditure so entailed. It became necessary not only to predict the gas volume, temperature, saturation and pressure loss, but also the gas composition—quite an achievement in say a plant for reforming oil gas from various grades of oil.

It must also be remembered that it was always possible to design several alternative sizes and shapes of condenser, any of which would perform the required duty but the selection of which was an arbitrary matter, depending on the relative importance attached to capital and operating charges. Again the use of a high fouling factor, or design margin—or factor of ignorance, if one preferred it—might sometimes prove valuable when someone succeeded in increasing the rated gas production from a carbonising plant.

In reply, **Mr. Cribb** said some of the matters which had been raised called for a written answer. But he would like to thank Mr. Norris for his valuable contribution, because he touched on some of the weaknesses with regard to the extension of the method to problems in other industries. As he had pointed out, in the gas industry they were fortunate in that only very low pressure drops could be permitted, and cooling and condensing was carried out at substantially atmospheric pressure.

With regard to the value of the ratio of heat to mass transfer coefficient, the method could accommodate a varying value of humidity, although if it varied with humidity and temperature it would be impossible to cope with it.

Mr. Norris had referred to their previous paper published in *Chemical Engineering*. They were unhappy about using the Chilton curve and carried out experimental work in the wetted-wall column, and proved a constancy of up to 90°F. Above that it was not important if it varied because mass transfer took over and allowance for heat transfer was not, therefore, very important.

With regard to his allowances for condensate, that was not so important in their case because of the high latent heat of water compared with its sensible heat.

Mr. Pollard had touched on the whole crux of the matter. The method could not be applied quickly to the reverse situation to obtain coefficients from test data, and that was really what they were after. They did not design condensers. They tested them.

As to Mr. Francombe's point, he could not believe that the refined method was uneconomic in the design of a condenser. If a condenser cost £20,000 and took three days to design instead of one, the question should be considered in terms of the present salaries of chemical engineers!

The University of Leeds

A course of 12 lectures on the manufacture of coal gas will form part of the programme of special courses of the 1956-57 session (second term) arranged by the Houldsworth School of Applied Science in association with the Department of Adult Education and Extra-Mural Studies, University of Leeds.

The section on carbonisation within the gas industry will be given by F. S. Charnley, Constructional Engineer, West Midlands Gas Board, in four lectures on January 14 and 21; while two lectures on the distribution of gas will be given by F. Bell, Chief Distribution Engineer, Southern Gas Board, on January 28. Gas purification will be dealt with in six lectures by J. J. Priestly on February 4, 11, and 18; while two lectures on the disposal of waste liquors produced in gasworks and coke ovens will be given by W. H. Blackburn, Research Chemist to the Joint Research Committee of the Gas Council and the University of Leeds, on February 25.

Also of special interest will be two lectures on gas and coke to be given on March 18 as part of a course on combustion in practice.

Intending students should send their names as soon as possible to the Secretary, Department of Adult Education and Extra-Mural Studies, the University, Leeds, 2, stating which course or courses they wish to attend. Other enquiries regarding the courses should be addressed to the Head of the Houldsworth School of Applied Science, the University, Leeds, 2.

From a paper presented at the Autumn Research Meeting of The Institution of Gas Engineers

The Measurement of Gas Steam Temperatures in Industrial Appliances

By P. G. ATKINSON, B.Sc.

MIDLANDS RESEARCH STATION, THE GAS COUNCIL.

ONE of the main factors influencing the amount of energy that can be extracted from a stream of hot gases is the temperature difference between the stream and the load it is required to heat. In an appliance, the temperature difference between the hot gas stream and the load, and also the absolute temperature of the gas stream, is continually changing as the flue is approached. It is clear, therefore, that the measurement of the temperature of a gas stream is of prime importance in the study of heat transfer processes in and efficiencies of gas-fired appliances.

At the Midlands Research Station of the Gas Council, investigations of heat transfer from gas streams are being carried out. It was evident from the start of this work that a major problem existed in the measurement of the temperature of a gas stream. Two points of interest arose from a preliminary survey of the literature on this subject. First: A good thermometer will only measure its own temperature; and secondly, a thermometer placed in a gas stream will seldom attain the temperature of the stream if that temperature is above, say, 300-400°C. If it is assumed that one has an accurate thermometer—and this in itself raises various difficulties—there remains the second point, that a thermometer will not normally be capable of measuring a gas stream temperature anyway. This is due to the fact that gas streams are usually transparent to radiation, and thus heat transfer by radiation can take place between the thermometer and its surroundings. The effect of this is that the thermometer will come to an equilibrium temperature somewhere between that of the gas stream and the surroundings.

Radiation Error

Experiments using thermocouples have shown that the effect of radiation between the couple and its surroundings may be quite large. This effect can result in errors of some hundreds of degrees at gas stream temperatures of the order of 1,000°C. This radiation error is dependent upon many factors and it is impossible to do more than guess at its magnitude under a given set of circumstances. The physical factors involved, to mention only a few, include the emissivity of the thermocouple and of the surroundings, the shape and size of the thermocouple, the velocity of the gas stream, the temperature of the gas stream and of the surroundings. Even if these are known, it is a laborious task to calculate the error and so to find the true gas stream temperature. It is worthy of mention that two thermocouples or thermometers having different physical properties can measure two different temperatures, even when placed in the same gas stream and under the same conditions.

The problem has been stated, its magnitude has been indicated—how was it tackled? First, a method of measuring true gas stream temperatures was developed that depends upon the temperature loss due to radiation being made up by the application of additional heat energy. Many practical difficulties were encountered and at an early stage it was realised that the method, although highly accurate, would prove to be of limited application due to the complexity and expense of the equipment required, and the apparatus could hardly be described as portable. At this stage it was clear that there was a need outside our own establishment, in the industrial development laboratories and elsewhere, for a portable instrument capable of being used by the non-physicist to measure gas stream temperatures.

Other workers have described various types of suction pyrometers relying on an increase in gas velocity over a thermocouple to bring its temperature more closely to that of the gas. These instruments increase the accuracy of the measurement but they do not eliminate the error entirely. Complex suction pyrometers may virtually eliminate this residual error which is again due to radiation—but they are necessarily larger than was deemed desirable for use in the gas industry, where the range of appliances includes quite small ones.

As a first step, it was decided to construct a small, all-metal suction pyrometer for use up to 1,100°C. Since all simple suction pyrometers have a residual error that cannot always be ignored, it was clearly essential to find the magnitude of this over the working range of the pyrometer. In other words, the instrument would have to be calibrated and a method of doing this using the original accurate instrument as a standard was deduced from theoretical considerations. A calibration test rig was then required, capable of providing uniform gas streams in the range of gas temperature of interest. In practice, this was found capable of providing streams of any temperature in the range 300-1,500°C. The temperature of the surroundings could be altered at will, without affecting the gas stream temperature, thus simulating a wide variety of conditions likely to be found in practice.

Calibration could not be carried out for the case where surroundings were hotter than the gas stream, due to the fact that the accurate instrument would have to be cooled to equalise the radiant energy exchange, and this has been impracticable so far. There is, however, theoretical support for applying the calibration curves to this case and reference to this is made in the paper. Having been calibrated, the metal suction pyrometer and its associated equipment was packaged into two boxes that are readily portable. The equipment was then tested in the field and found to be easy to use by one person. A feature which really stands out when using the instrument is its very high speed of response. It has been used to measure gas temperature changes occurring in cyclic processes, and it is possible that it could be used where nothing else but an extremely fine wire would have the necessary speed of response. Work is continuing with the aim of producing a calibrated refractory suction pyrometer capable of being used up to temperatures of the order of 1,500°C.

Finally, there is plenty of waste heat remaining unrecovered in the gas industry and elsewhere, due to incorrect gas temperature measurements being recorded and used as a basis for economic consideration. Usually these measurements err on the low side, and no doubt economically suitable heat recovery systems have been condemned through this reason alone. It is hoped that this instrument will help in increasing the efficiency of these and many other industrial processes.

Portable Instrument

For the convenience of the industrial gas engineer, the calibrated suction pyrometer has been made portable, the entire equipment being contained in two cases. One case contains the following items:—

(i) Suction line (including heat dissipator);
(ii) compensating cable and indicating instrument;
(iii) A.C. mains lead, and
(iv) motor and pump unit.

The other case carries two pyrometers. The arrangement of the equipment is shown in Fig. 1.

In use, a pyrometer head is attached to the heat dissipator by means of the ¼ in. stud on the tee-piece of the pyrometer; the connection is facilitated by a swivelling coupling on the heat dissipator. As its name implies, the heat dissipator is a gas-to-air heat exchanger in which the gas is cooled before passing on to the reinforced poly-vinyl chloride extension lead and to the pump. Because the dissipator has to withstand high temperatures, without leakage, it was decided to use a completely seamless bronze tube constructed in bellows fashion. This is braided overall for rugged service and is approximately 10 ft. in length. The extension tube is also 10 ft. long, thus giving an overall length to the suction lead of 20 ft. so that the pyrometer head can be positioned at up to 20 ft. from the measuring equipment.

The thermocouple used is a chromel/alumel type and, due to its small size (0.062 in. diameter), it has a resistance of the order of 7Ω per unit. A 20 ft. length of compensating

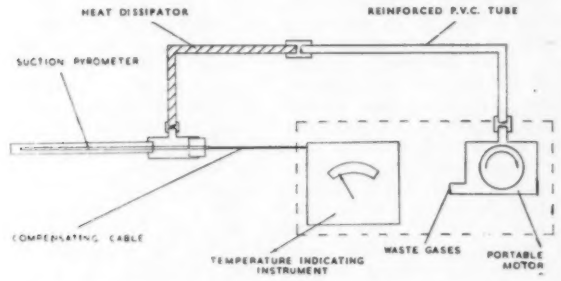


Fig. 1. Equipment used with the metal suction pyrometer.

cable is used to connect the thermocouple to the indicating instrument. This cable is essential, since the socket at the rear of the pyrometer head will vary widely in temperature, and, therefore, cannot be used as a cold junction. As the resistance of this cable is 0.453Ω per ft., a total external resistance of approximately 16Ω is connected to the moving-coil instrument. The movement of this should have a high internal resistance in order to minimise the error due to a change in external resistance with temperature. This is achieved by using a double magnet assembly to bring the internal resistance up to approximately 750Ω. The instrument is calibrated for an external resistance of 20Ω. An external resistance bobbin may be used to increase the total external resistance to 20 Ω but the error introduced by omitting this is only of the order of 0.5%. The scale length is 8 in. and the reading accuracy is within 1%. The cold junction temperature is measured by a thermometer placed near the meter terminals.

The motor and pump unit is a compact high-performance unit working on the rotary-vane principle. The motor is of ½ h.p., running at 10,000 r.p.m., integrally coupled to the pump. The weight is only 10 lb.

Valve Not Necessary

It has already been shown that the effect of the variation of pyrometer reading with its throughput is negligible providing this is above about 40 cu.ft. per hour measured at room temperature. Using this pump with the suction pyrometer already described, the throughput is never less than 45 cu.ft. per hour under any normal working conditions, so it is not necessary to provide a valve for controlling the amount of suction. A hold-on type of switch on the meter panel is provided to operate the motor, so that suction will not be left on inadvertently for long periods. Vibration from the motor to the meter movement is minimised by the use of a suitable motor cradle and anti-vibration mountings, which isolate the motor from the box.

The method of use is as follows: A ¼ in. clearance hole is bored through the brickwork, etc., so that the pyrometer can be inserted to the position at which a temperature measurement is required. The meter is short-circuited and the cold junction temperature is set up on the scale by means of the zero adjustment, after which the shorting link is broken and the compensating leads connected. The meter reading is taken as soon as temperature stability is reached. The motor switch button is depressed and held down until another steady reading is indicated. These two readings are recorded as non-suction and suction readings respectively.

If t_c is the temperature of the thermocouple without suction, and t'_c the temperature of the thermocouple with suction, then the true gas temperature, t, is determined as follows:—

(i) Calculate $t_{av} = \frac{t'_c + t_c}{2}$.

(ii) Find the 'efficiency' of the pyrometer from Fig. 2 or for this value of t_{av}.

(iii) Calculate the true gas temperature from the formula:

$$t = t_c + 100\,\frac{(t'_c - t_c)}{E}$$

To illustrate the procedure the following example is quoted:—

Suction reading, $t'_c = 929°C.$

No-suction reading, $t_c = 714°C.$

$\therefore\ t_{av} = 822°C.$

From the curve the efficiency $E = 74.7\%$.

Hence the true gas temperature is given by

$$t = 714 + \frac{100 \times 215}{74.7}$$

$$= 1{,}002°C.$$

It is worth noting that, when a series of similar readings are being taken, if the results of the first reading show that the correction may be neglected, it is only necessary subsequently to take the suction reading.

In a prototype oil-gas plant, it was found that during a 3.8 minute blow period the temperature at a certain position rose to 710°F. The blow period was part of a cycle of events lasting for about 9 minutes. During the remaining 5.2 minutes of the period, steam was admitted to the system. The temperature of 710°F. was measured by means of the usual industrial type of thermocouple, ⅜ in. diameter with a stainless-steel sheath. Arrangements were made to carry out measurements with the portable suction pyrometer. Due to the relatively low temperatures involved, it was not necessary to apply any correction for the error of the suction pyrometer; consequently, readings without suction were unnecessary. This meant that the very high speed of response of the suction pyrometer could be used to follow the changing temperature through this rather short period (3.8 minutes). In fact, readings were taken at 10 second intervals throughout this period, although only the initial and final temperatures are quoted below:—

	'Industrial Thermocouple' (°F.)	Suction Pyrometer (°F.)
Temperature at start of blow period (after 10 seconds) ...	420	780
Temperature at end of 3.8 minutes	710	940

The errors of 360°F. at the start and 230°F. at the end of the blow period were due to two factors, the first being that the large thermo-couple was quite unsuitable for temperature measurement over a short-period cycle, because of the long

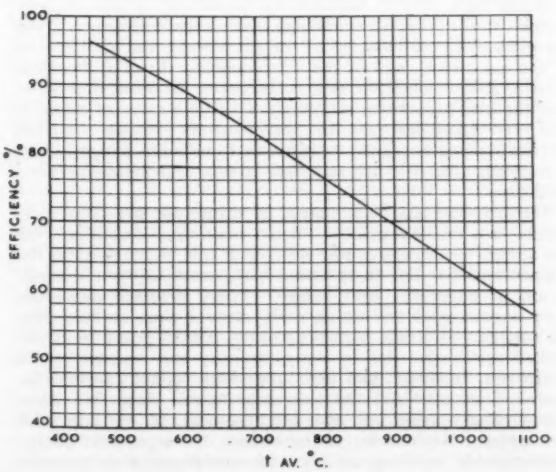


Fig. 2. Calibration curve for the metal suction pyrometer, in °C.

time constant inherent in its design. During the period when steam was admitted the suction pyrometer gave a reading of approximately 212°F., but the thermo-couple temperature fell slowly from 710° to 420°F. at the start of the next blow period. The second factor was that since the surroundings of mild steel were unlagged and, hence, relatively cool, there were radiant losses from the couple sheath.

This test showed not only the value of the high speed of response of the instrument, but also that large errors may exist if industrial types of thermocouple are used for temperature measurements of a cyclic nature.

DISCUSSION

Mr. R. F. Hayman, Industrial Gas Officer, the Gas Council, said that the design of fuel-using equipment had advanced substantially in recent years, and increasing costs of fuel had necessitated closer attention being paid to performance, thermal efficiences, and other factors which reduced running costs. To facilitate the control of operation of plant, often large and expensive to run, a great deal of thought had been given to new instrumentation.

He went on: 'With a little extra information it is possible on most plants to conduct a heat balance. One thing remains, however, to which not nearly enough attention has been paid. This is the measurement of gas temperatures. The whole of the analysis of performance of equipment hinges on the correct measurement of the temperature of gas flows in enclosed spaces, and for years many competent authorities have been deluded by calculations which have involved substantial errors in temperature measurement. There are many methods for measuring such temperatures, but they are all subject to errors which cannot be checked. There is no doubt that for any equipment where the temperature of a wall may be different from the temperature of the gas stream inside it, it is necessary to take the greatest care in eliminating errors induced by radiation to or from the measuring instrument.'

Last year, the Midlands Research Station had produced Research Communication No. GC23—' An Investigation of Explosion Reliefs for Industrial Drying Ovens," by Cubbage and Simmonds. Equipment incorporating explosion reliefs was now in full production as a result of this work, said Mr. Hayman.

This year they had this most important paper by Mr. Atkinson, and it was equally vital that the work was translated into practice as quickly as possible. It was surely refreshing to see in the midst of a spate of new instruments, mostly electronic, designed to record physical constants including temperature, more quickly or more at a time, a simple instrument which would feed these new marvels with accurate information.

Mr. Hayman went on: 'Although it is normal for the gas stream to be hotter than the containing walls, there are two well known systems in which the reverse is true. One is indirect heating, and the other is the use of radiant heating tunnels and similar equipment. When one tries to assess the significance of convection in radiant heating tunnels it is necessary to measure the air temperature. There must have been many errors in the past in attempting to do this. Does the author see any profound difficulty in calibrating his instrument to cope with conditions, which in direct heating systems may involve quite high wall temperatures and in radiant heating equipment would be unlikely to meet air temperatures greater than 300°?

'It is essential to realise that a suction pyrometer in itself will not solve all gas temperature measurement problems. As the author says, it must be calibrated to establish the magnitude of residual error, and like many other instruments it should be checked regularly. I should like to see this problem taken more seriously—perhaps by the establishment of service contracts, because there seem to be far too many expensive instruments lying idle or working inaccurately.

'The Atkinson pyrometer, if I can call it that, has far greater uses than the measurement of flue gas temperatures in gas appliances.'

Mr. Hayman added that it was hoped that at least all research development and testing establishments, having any problems of gas temperature measurement—'and there must be very few who have not'—would acquire this valuable instrument.

Dr. R. Jackson, B.C.U.R.A., said that Mr. Atkinson had designed a neat instrument which was portable and easily used.

'Some time ago the author discussed the problem with me, and he was very concerned because someone might ask him why he wanted to measure true temperature. I told him that he should not worry about that because most people thought they were actually measuring it, although their errors might be considerable. I should like to reinforce the examples he gave by an even more outrageous one. One of our friends some time ago disagreed with our estimate of his gas temperature and endeavoured to measure it. He obtained a reading of 600°C., and we thought this was wrong. Therefore we built a special instrument to measure the temperature. That was necessary because the gas was in a water cooled surround. We found that the reading of 600° was in error by 800°C., the true reading being 1,400°.

'I would cross swords with the author on whether, having revealed errors, his own instrument goes far enough in eliminating them. I wonder whether possibly an instrument of increased accuracy may give people an enhanced trust in the temperature measurement while still leaving an error which they would then have less reason to suspect. Errors due to radiation increase at higher temperatures, and while the single radiation shield is being accepted as satisfactory at low temperatures, it is usual to increase the number as the temperature goes up. The author has avoided that in the name of simplicity, and has endeavoured to overcome the complication by calculating the efficiency of his instrument and using that value to correct his final reading.'

Dr. Jackson went on: 'In view of the possible errors at the high temperatures I do not think that the author's argument that metals can be used in this instrument for measuring temperatures at which they would normally become unusable and begin to sag is valid. The author may realise that the instrument should only be used at low temperatures, but I can assure him that people will use it up to the limit. In fact some of our own people are intrigued by it and have been using it at temperatures up to and over 1,000°C.

'I should, however, like to refer to a fact which was rather surprising to me. Although the instrument was placed directly in the stream of extremely dirty gas, it showed no sign whatever of blockage. I think that may be a useful feature.

'Finally, could I ask the author whether he has considered using a pneumatic pyrometer which has an even faster response —something of the order of one or two seconds—and does not have to be calibrated?'

Mr. H. T. Cohen, Humphreys & Glasgow, Ltd. : 'Normal control instruments used for measuring temperature of gas in industrial systems give at best only an approximation of the true temperature. While this is good enough for control purposes, it is no use for obtaining design data. The suction pyrometer is probably the only answer to this problem. Most suction pyrometers have been rather cumbersome pieces of equipment and not suitable for carrying round an industrial plant. The apparatus described in the paper is a definite step forward. It is light, easy to handle and enables one to record temperatures in awkward places which would be impossible with larger units.

'I am closely associated with a plant using cyclic processes, and here of course accurate temperature measurement becomes more difficult than ever. Not only are there differences in the temperature of flowing gas, but there is also a continual variation in flow. The very small mass of the probe of the apparatus gives quick response to these changing conditions, but its small size also has a corresponding disadvantage, for unless the gas is substantially clean, there is a danger of choking after a short time. I hope that the author will find some way of overcoming this in the future. In the meantime, the apparatus has been found to be extremely useful in obtaining data on a plant where speed of operation is of great importance.'

Mr. E. Thornton, Watson House: 'The industrial laboratory at Watson House has been privileged in having one of the first of these portable suction pyrometer units to be allowed out of the range of Mr. Atkinson's personal supervision. During the last six months it has been employed both in the laboratory and in various industrial premises, and has been found to be a very useful and versatile instrument, particularly with the less accessible flues so often found during district tests.'

(Mr. Thornton then commented on three points in the theoretical portion of the paper.)

He continued: 'The principal difficulty in measuring gas stream temperature is to obtain the average value, and this can be determined only when both the temperature and velocity distributions are known. At present it is much more difficult to determine velocity distributions with relatively simple equipment than to measure temperature distribution. This is particularly true of gases at high temperature. The development of a simple technique for measuring both the direction and magnitude of the velocities of hot gases would be of great value.

'Another suggestion for further work arises from the fact that measurements of wet-bulb and dry-bulb temperatures are frequently required in practice. This instrument could probably be developed into a very good wet and dry suction pyrometer. Finally, perhaps Mr. Atkinson would be good enough to give us an equally satisfactory surface pyrometer.'

Mr. L. T. Minchin thought it was a very wise move on the part of the Midlands Research Station to concentrate first of all on getting some accurate means of measuring flue gas temperatures. His main criticism was that it seemed to him that for the pyrometer which was going to be used, it was important that any correction which may have to be applied should be as small as possible. In one of the examples given in the paper of an oil gas plant, it was stated that corrections were unnecessary because the temperature was low. It should be the aim to raise that minimum temperature at which corrections were unnecessary to as high a level as possible. He thought that might be done if steps were taken to see that the shield round the couple was as near as possible to the temperature of the gas. If the shield were designed to come to the temperature of the gas quickly, one might find that in practice one need not go through all the troublesome business of determining E.

Mr. W. N. Smirles, West Midlands Gas Board, considered that the instrument which had been developed would prove of great use, not only in industrial heating, but also in other sections of the gas industry.

He went on: 'In all uses of gas as a fuel, heat is first developed as a hot fluid, the composition and movement of which may be well defined; but accurate knowledge of its true temperature at times is sadly lacking. This work now seeks to remove that disability, and in fact has partly done so. I have no doubt that the author himself would wish that the temperature range of the instrument was much wider, and I should look forward with great interest to a suction pyrometer which would measure temperatures approaching flame temperature, but whether this will appear other than as a laboratory type is much open to doubt. Nevertheless, the present instrument fulfils a long felt want and should be useful in the determination of flue temperatures, the performance of drying ovens, etc.

'Let us turn to some aspects of its practical application. It has obvious advantages in the way of portability, not perhaps as an instrument of routine use, but rather for those installations in the field where more precise information would be an advantage. The dimensions of the instrument have been carefully selected and provided that good support of the probe head can be assured, there are no great difficulties associated with its use.

'In order to improve the versatility of the apparatus, it might be well worth considering the supply of two probes in the standard pack, one much shorter than the present one. In this connection, a point arises with reference to the heated length of probe. This contains a fine wire thermocouple of fairly considerable resistance. A furnace which gives a short heated length in contradistinction to one requiring the full length to be heated might quite conceivably give a different temperature result on account of the change in resistance of the larger length of wire on suction being applied.

'The accuracy of the instrument depends on two factors. First, it depends on the accuracy of its calibration with the true gas temperature pyrometer and, secondly, on the retention of that accuracy. Dealing with the second point first, I would like to ask the author if the calibration changes and the nature of the couple and sheath surfaces change, as they might well do, due to exposure to high temperature gases.' (Mr. Smirles developed these points at some length.)

Mr. H. R. Smith, Derby, said there had been some criticism of the accuracy of pyrometers due to various potential sources of error, but he felt that they are comparatively unimportant. This pyrometer had been developed to assist in part in the design of industrial gas equipment and in part to check the design results in the field. There were, of course, difficulties in that the gas supplied on the district main gave rise to errors of 5% or more in the heat input to the appliance. The errors in this instrument were comparatively insignificant so far as the purpose for which it would be used was concerned.

Mr. Smith asked the author whether he had any knowledge of the behaviour of the pyrometer up to the limiting temperature at which it could be used and whether he could give any information on the life to be expected from the pyrometer at comparatively elevated temperatures of, say, 1,000°C. and the frequency with which it was required to make a check of the thermocouple to see that it was still up to standard.

Mr. Atkinson, replying, said he would like to answer many of the questions in writing at a later stage.

He said: 'I knew that this was a controversial subject, and I have been very interested to hear the views which have been put forward. I should like in particular to mention the points raised by Mr. Hayman. The physical properties of the particular pyrometer are those I mentioned in the presentation of the paper, that is, such things as emissivity, shape, dimensions of the couple, dimensions internally, diameter of the hood, external diameter, and the thermal conductivity of the materials. There is a long list and that is why I grouped them together and called them "physical properties," the importance being that the calibration applies only to that particular type of suction pyrometer made to the same specification throughout. Any other pyrometer constructed may or may not have similar characteristics depending on the nature of the materials used. There is no difference theoretically in the calibration of the refractory type of suction pyrometer. We have in fact started calibrating it now, and obviously the physical constants are different, and the calibration curves will be of a different shape: but theoretically the calibration is very similar.

'The other point which Mr. Hayman raised concerned the question of different conditions where the surroundings were hotter than the gas stream. That was theoretically possible. It was merely a question of the practical difficulty of cooling a hood rather than heating it. It is easier to heat a refractory material by means of a platinum winding than to cool it by air or some other means. However, it is receiving my attention, and if the practical difficulties can be overcome, the calibration will certainly be conducted in this region.

'There is no theoretical reason why the calibration curves would not be applicable in this state, and if the difference between the suction reading and the non-suction reading is small, I can see no argument against using it.

'Dr. Jackson has raised many questions. I did look into the method of calibration to which he refers, and without going into it at all deeply here, I should like to point out that in that case, Land and Barber did not in fact measure true gas temperatures at all. I was not satisfied that the system would be applicable to the simple shield as used in our case.

'The question of blockage has been mentioned, and I was very interested to hear, having had no experience of dirty gases, that the instrument does not in fact block where the larger instrument does block. It is possibly due to the momentum to the fly ash and so on being sufficiently high not to be drawn into the small suction diameter which needs very little suction throughput.

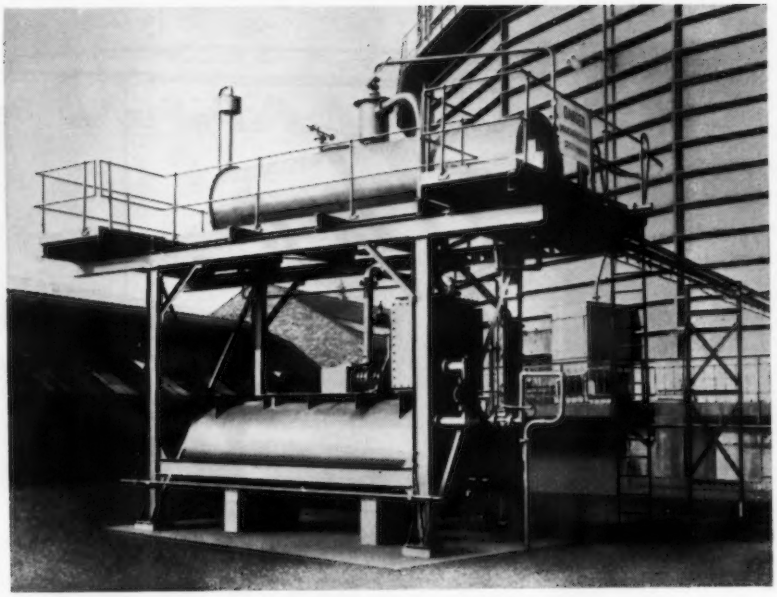
'Mr. Thornton raised several points, and some of them I should like to leave to the written reply. I must apologise for not mentioning the spider in the pyrometer which, as he rightly says, is an important part, practically speaking, and it does in fact position the couple so that the tip does not touch the hood.

'Mr. Minchin raised a point about the complex hood. It is, of course, difficult from the practical point of view due to the small size of the suction pyrometer—necessarily small due to the nature of its use. The critical features of the pyrometer and its size are chiefly connected with those of the thermocouple. The couple shield and its diameter is still only $\frac{1}{16}$ in. It suffers from many drawbacks. It does not maintain its calibration very accurately, and therefore anybody using one of these suction pyrometers would be wise to calibrate it as the normal procedure for the calibration of any thermocouple. It is useless to use a thermocouple reading if it has not in fact been calibrated so that it can measure its own temperature accurately.'

A Tar Reconditioning Plant for a M.A.N. Waterless Holder*

By D. ASTBURY

North Western Gas Board, Bradford Road Works, Manchester.



THE Bradford Road M.A.N. waterless holder built in 1929 has a capacity of five mill. cu.ft., and is weighted to give a uniform outlet holder pressure of ten in. w.g. During the 1930's benzole recovery was being carried out and there was a tendency during the summer months for the sealant to lose light oils to the gas. These light oils were not regained by the sealant in the winter, and this caused a gradual thickening of the sealant, but this was countered by the replacement of sealant with an equivalent volume of dehydrated tar.

During the war the holder was out of commission, but after recommissioning there was a slow deterioration in the quality of the sealant, due to the gradually increasing production of gas and the discontinuance of benzole extraction. The holder is not used as a static storage holder, but an average of between 18 and 20 mill. cu.ft. of gas a day passes through it at the present time, a quantity vastly in excess of the volume passed in the pre-war and immediate post-war years.

During the operation of the holder the sealant becomes emulsified with water condensed from the gas, and the tar/water emulsion thus formed is only broken down with great difficulty. These tar/water emulsions have a higher viscosity than the original sealant, and added to this, as benzole is no longer recovered, benzole is also absorbed from the gas in the holder; this counteracts to some extent the increase in viscosity due to the formation of the tar/water emulsion.

Emulsion Formation

The formation of the emulsion in the waterless holder takes place at the rubbing bars, where the tar film on the plates of the holder is covered with a condensed water film from the gas. When the piston falls, the two overlaid films are subjected to considerable shear and emulsification occurs. As the emulsion flows down the holder walls it is modified in both light oil and water content, depending on the gas and atmospheric temperatures. From the dam this emulsion passes to the bottom collecting tanks, where if no separation of water takes place it is returned unchanged to the piston seal by the pumps.

Various methods of breaking down the emulsion have been tried. A ring steam main was run immediately below the dam in the holder cellar, to raise the temperature of the sealant in the dam and so assist in the separation of water, and possibly, to volatilise some of the light oils back into the gas. The separating tanks were also fitted with steam heating coils for the same purpose. Some separation of water did take place, but it was found each year with the onset of the colder weather that the sealant rapidly increased in both light oil and water content. A typical sample from the seal contained up to 35% water and 6% light oils, in spite of large quantities of water being separated and removed daily. In the winter of 1951-52 a surface active agent (amine 220) was used in a concentration of 0.02%, which proved to be extremely effective as a demulsification agent, and large volumes of water were removed from the sealant. The water content of samples taken from the seal were rapidly reduced from 30-40% to only 2-3%. However, the sealant had by this time absorbed 7-8% of light oils, so that the removal of the water emulsion caused a rapid fall in viscosity from 160-190 seconds to 50-60 seconds at 50°C. (No. 1 Redwood Viscometer).

After this, however, no addition of surface active agents was made to the sealant, and the tar/water emulsion gave a higher viscosity of the order of 140-170 secs. at 50°C. with a water content of 25-45% and a light oil content of 6-8%. Working the holder during periods of extreme cold weather with a tar/water emulsion causes difficulties, since the emulsion as it flows down the walls of the holder from the entry ports of the piston seal, is broken down by the frost, and the water freezes in the form of a snowlike mass which settles in the seal. The partly demulsified tar thinned by light oil can seep slowly from the seal and leave behind it a mass of porous flake ice through which the gas can escape. In extreme weather the ice must be removed manually. This and the cost of the almost annual renewal of the whole of the sealant in circulation showed that the problem would only be solved by installing a plant capable of removing both water and benzole from the sealant.

Such a plant has been designed by W. C. Holmes & Co. Ltd. under the name of the Holmes Tar Reconditioning Plant, and will remove water and benzole. This plant is capable of dealing with tar sealant containing about 15% of water by volume from the holder at a rate of some 200 gall. an hour. A flow diagram shown in fig. 1 consists of the following:

Treater vessel, spray arrester, condenser, separator, gas booster, sealant delivery pump, and instrument panels.

Operation of the Plant

The sealant is withdrawn from the bottom of the holder dam at a point nearest to the plant, and after passing through the small feed pump is metered and fed through a three in. diameter pipe to the funnel and seal on the inlet side of the treater vessel, which holds approximately five tons, and leaves by the constant level seal.

On its passage through the vessel the sealant is heated up to the required temperature by means of the closed steam coils, and coal gas from the booster at a pressure of three lb. per sq, in. is passed through it by means of the perforated distribution pipe. The coal gas acts as a carrier for the water and light oil vapours, and by keeping the sealant in a

* Abstracted from a paper presented to Manchester Junior Gas Association on December 12.

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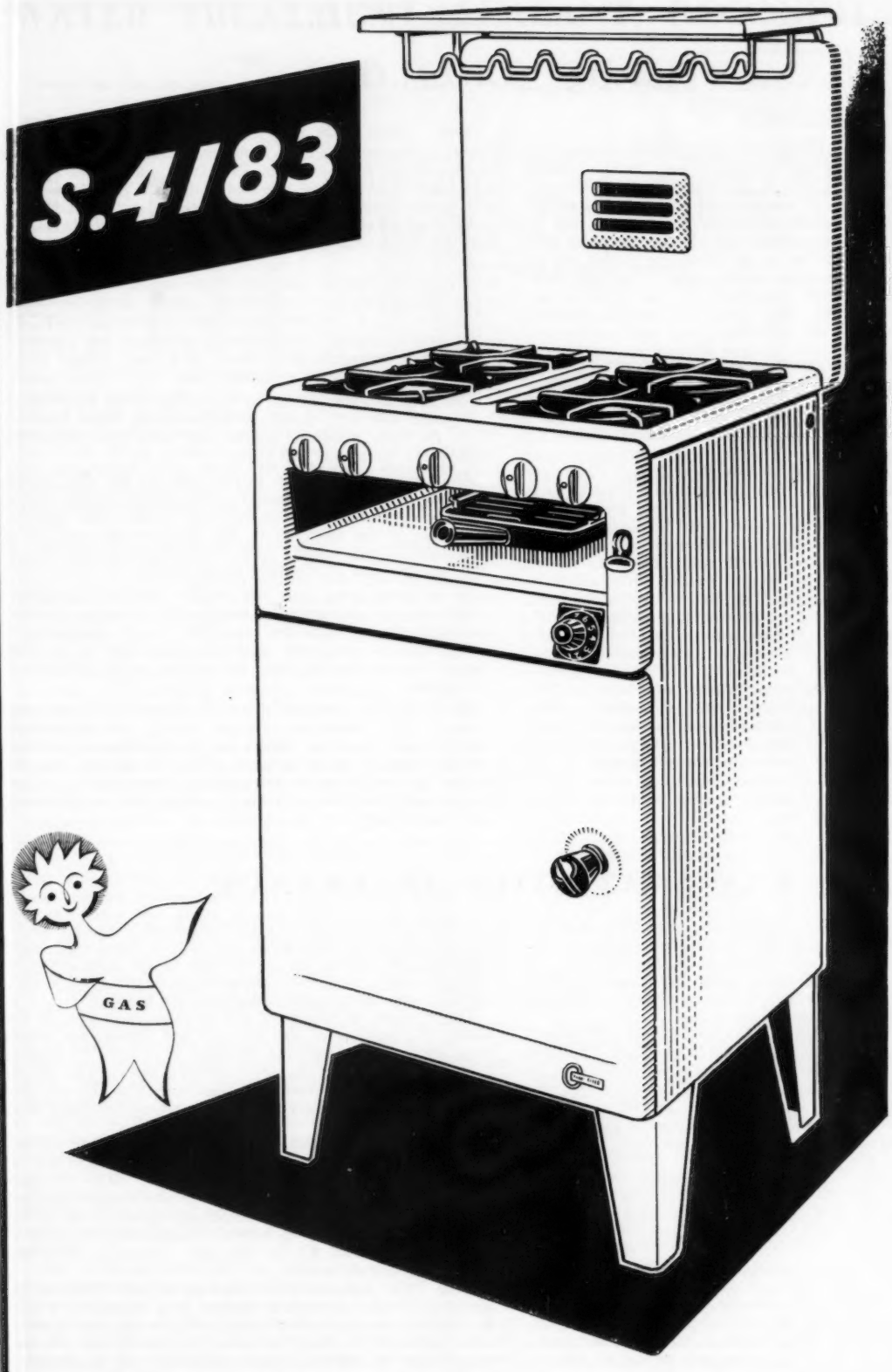

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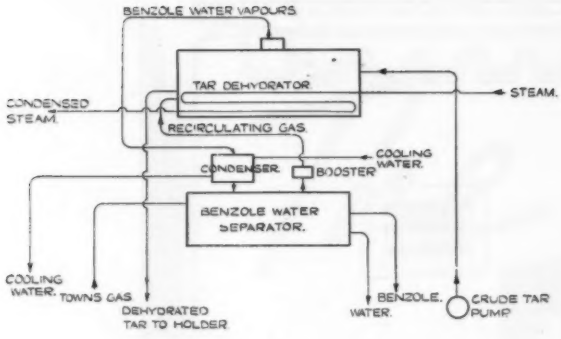

Fig. 1.

turbulent state in the treater vessel assists in the prevention of 'priming' when high water contents are being encountered. It also prevents oxidation of the sealant during treatment, and simplifies the problem of non-condensible vapours from it, since any excess of gas will feed back via the gas supply pipe into the inlet holder main. The hot treated sealant leaves the vessel and flows into a small receiving box through an unlagged four in. diameter pipe to a point diametrically opposite to the plant feed, and from there it is fed back into the bottom of the dam. The return of the sealant to the holder is by gravity. Any blockage in this return line to the receiving box causes a float actuated switch to cut off the power supply to the feed pump and give audible warning to the holder attendant.

The plant, which is operated during the day by the holder attendant for approximately eight hours, processes sealant at the rate of 190-210 gal. per hour giving a daily throughput of 1,700 gal., or 8.5 tons. As the holder system contains approximately 90 tons of sealant, the whole of it is treated once every fortnight. At present the plant is only being operated from Monday to Friday, but before it would be possible to operate the plant continuously, fuller instrumentation and the control of the supply of steam would be necessary to give a constant temperature of the sealant in the treater vessel. A high level float device would also have to be fitted to the light oil storage and separator vessels for automatic cut-off, in case this storage became full.

Table 1 shows the results of operating the plant from September 21 to October 30.

Table 1.

	SEALANT IN TO PLANT			SEALANT OUT OF PLANT			
Date	%H_2O	% Light oils	Visc. at 50°C.	%H_2O	% Light oils	Visc. at 50°C.	Temp. tar in treater
21/ 9/56	9.3	4.8	137	0.3	4.0	190	88-90°C.
25/ 9/56	3.3	—	—	*Nil*	—	—	88-90°C.
27/ 9/56	2.7	2.3	164	0.2	1.7	221	88-90°C.
1/10/56	9.3	1.5	185	0.2	1.3	250	88-90°C.
3/10/56	9.3	1.7	173	*Nil*	1.2	245	88-90°C.
10/10/56	17.3	3.8	169	1.8	1.2	234	88-90°C.
12/10/56	13.5	2.7	151	*Nil*	1.7	217	88-90°C.
16/10/56	10.4	2.7	172	0.1	1.5	235	88-90°C.
18/10/56	3.5	3.2	193	0.1	2.3	300	88-90°C.
22/10/56	1.4	1.1	190	*Nil*	1.0	300	94-96°C.
23/10/56	3.4	2.1	181	0.3	1.5	232	94-96°C.
24/10/56	0.8	2.0	192	*Nil*	0.3	342	94-96°C.
25/10/56	3.0	1.2	202	0.7	0.9	349	94-96°C.
29/10/56	5.2	1.3	227	0.2	0.8	300	88-90°C.
30/10/56	3.0	0.6	233	0.8	0.5	323	88-90°C.

The average water content in the sealant at the beginning of the period was 20%, though it would appear lower than this from the table since the sample was taken from below the dam where the tar was well settled.

The series of tests given in the table on the inlet sample show the gradual improvement in the quality of the sealant, while a comparison of the inlet and outlet tests gives an indication of the efficiency of the plant for the removal of both light oil and water. 95% of the water is removed and 35% of the light oil distilling up to 160°C.

It has been noted from the results obtained of complete distillation tests on the sealant samples that there is a tendency for the heavier tar oil boiling up to 220°C. to be removed from the sealant in very small quantities. This loss is so slight that it has no apparent short term effect on the qualities of the sealant.

But if this loss continues and does not reach an equilibrium with the slight absorption of higher boiling constituents from the gas then fractional distillation of the light oil distilled off may have to be undertaken with a bleed back into the sealant of the higher boiling residue. Alternatively, a predetermined proportion of a light creosote could be bled back into the sealant.

GAS STATISTICS IN FRANCE

GAZ DE FRANCE, Commercial Direction, published recently the statistics of the Service National for the year 1955. These statistics were presented in the form of an 'elegant brochure' illustrated by graphs and photographs in colour. We have made the following abstracts from the summary in the *Journal des Usines à Gaz*.

Sales of gas rose in 1955 to 3,103 mill. cu. m. (109,600 mill. cu.ft.) at 4,200 cal. per cm. (440 B.Th.U. per cu.ft.), including gas transmitted under toll and sold to other distributors, an increase of 4.6% over sales in 1954. The increase is 16% over sales in 1951 and exceeds 32% over those in 1947.

The increase from 1954 to 1955 of volumes of gas available for sale is greater, 6.2%, because there has been an increase in 'gas unaccounted for.'

Sales for domestic use showed an increase of 3.5%, for commercial use 6.3%. While sales to bakeries continue to decline there are large increases in commercial cooking, 10%, central heating, 10%, pork and cooked meats, 7%, and miscellaneous uses, 9%.

Industrial sales in 1955 showed an increase of 6.8% over those of 1954. In the most important sector, the metal treatment industries, there was a growth of 6%, while there were notable increases in metal production, 38%, and in ceramics, 23%, while there were average increases of 7% in the general food industries, 6% in the glass industry, 6% in the chemical industry and a slight recession in the textile industry, 4%.

Production: Concentration of production in 1955 was marked by the transformation or shutting down of 40 works; of these eight were shut down; 23 were connected to trunk systems, including 16 in the Paris Region and the East (following the development of the great trunk main from the east to the coke plant at Alfortville), and five in the Lower Seine following the coming into production of the coke ovens at Grand-Quevilly; nine small undertakings turned over to propane-air, one (a new installation) to pure propane.

The diversity of sources of gas is shown each year in the nature of purchases of gas, coal gas and natural gas, which have grown during the year by some 40% and 10% respectively, to which must be added refinery gases. The use of coal and petroleum products declined somewhat (by 4% and 11% respectively), while purchases of propane continued their rapid growth, by 43%.

Consumers: The number of domestic consumers reached on December 31, 1955, 4,925,000 (a record), an increase of 1.74% over the number at the end of 1954. Sales of appliances reached a new high level. There was a slight increase, 2% in sales per consumer, approximately equal to that in the three previous years. Commercial consumers continued to grow rapidly, about 8% in the year; industrial consumers remained relatively stable.

Coke: The decrease of 4%, compared with 1954, of the quantity of coal carbonised, resulted in a decline of 3% in the quantity of coke available, but stocks having also declined sales remained at about the same level as in the previous year. Sales to small consumers (domestic and small industries), which represent half the total, declined slightly, 1%. Deliveries to industry varied little, but their distribution changed in favour of supplies to the steel industry, higher by 32% than those in 1954, while those to other industries declined by 5%.

WATER TREATMENT, SEALANT, RECONDITIONING AND COKE QUALITY

THE December meeting of the Manchester District Junior Association of Gas Engineers, held at the Manchester Industrial Gas Centre, Whitworth Street, Manchester, was devoted to three papers in the annual competition for the prize which commemorates the services given to the Association by the late Mr. F. Johnston as secretary for 13 years (1934-47).

The papers covered water treatment, sealant reconditioning at Bradford Road Works, Manchester, and coke quality. Mr. T. Nicklin, President, was in the chair.

In the first paper, Mr. J. Parkinson, Southport Works, Liverpool Group, dealt with 'Lime soda treatment of a variable crude water.' He said difficulties were encountered for a number of years at the works in processing feed water derived from a brook flowing through low lying, peaty land, one of the many drainage channels removing surface water to the sea, for steam raising purposes. Those were due to variations in the composition of the water and to their full extent not being appreciated for a time. Last January, however, a closer investigation involving daily analyses led to some unexpected results.

Mr. Parkinson demonstrated by graphs the change in total, temporary and permanent hardness over a period of months. The total hardness varied erratically from day to day by as much as 150 ppm. There was a seasonal reduction in permanent hardness from a maximum of 220 ppm. in the winter to approaching zero in summer. It was apparent that those variations were connected with the local rainfall, although further investigations had not yet been carried out. Hardness in water, which may be temporary, permanent, or both, was due to the presence of salts of calcium and magnesium in solution.

Temporary hardness was caused by the presence of bicarbonates of calcium and magnesium, being so called because it might be removed by boiling the water. Permanent hardness was due to the sulphates, chlorides, etc., of calcium and magnesium and was not decomposed by boiling.

Hot Lime Soda Process

In order to treat the water for steam raising purposes, those salts must be removed, otherwise scale formation would occur in the boiler due to the decomposition of the bicarbonates and the concentration to saturation point of the permanent hardness salts. Southport treated the water by the hot lime soda process which involved the use of the mixture (magma) of calcium hydroxide ($Ca(OH)_2$) and sodium carbonate (Na_2CO_3) closed in controlled amounts to the raw feed water.

Mr. H. G. Hall, Board H.Q., said he had been impressed as he visited gasworks by the amount of steam wasted. That steam was produced from water and was a first-class boiler feed. More could be done to utilise steam that was being blown to waste.

Mr. H. K. Nicholas, Manchester, referred to the two steam turbines at Partington and said corrosion found inside was attributed by one of the men to the feed water and by another to foreign matter, which damaged the turbine by abrasion. In his view it was a characteristic of gasworks that when steam turbines were installed any deficiencies in water were discovered and it seemed that the lime soda process involved a lot of control.

Mr. Parkinson said that for every 100 gal. of water the change of soda lime and soda aluminate was added. The feed water was tested early every morning and, if found satisfactory, the change was correct. If there was too much hardness, then it was ascertained how much chemical should be added to bring it to the required standard. Rainfall affected the water to a definite extent.

Author of the second paper, Mr. D. Astbury, Assistant Principal Chemist at the Bradford Road Works, described 'Operational problems on a waterless holder leading up to the decision to install the tar reconditioning plant.' He gave an account of the problems encountered in the operation of the holder due to deterioration of the sealant into a tar-water emulsion, and its absorption of light oils. The treatment had led to a considerable improvement in the quality of the whole of the sealant in circulation in the waterless holder system. The increased viscosity was reflected in a considerable increase in the overall circulation or in the number of 'pump runs.' Rises and falls in atmospheric temperatures, and variations in the depth of seal on the piston were among factors which affected the number of pump runs. Working conditions inside the holder were much improved due to the absence in the atmosphere of benzole vapour volatilised from the sealant. Previously that had necessitated the occasional wearing of masks by the holder attendant and his assistant.

An extended version of Mr. Astbury's paper appears on p. 91.

On the Right Lines

The plant was a real advance on the right lines, was the opinion of Mr. R. L. Greaves, Vice-Chairman of the Manchester District Section, I.G.E.

Mr. O. Clyne, contractor, said at first they were concerned over frothing. The steam coil was run at a fairly high temperature and when the cold air hit the heating surfaces without having adequate ozitation it tended to froth. This was remedied by modification to the ozitator. Water did not have a great effect on the viscosity of the tar unless in emulsification when light oil was present. The water content of the tar was determined by the amount of gas going through the holder and also by the drop in temperature in the holder. Efficient cooling of the gas prior to entering the holder considerably reduced the water content. The installation was a prototype from which a lot had been learned. Further installations would be somewhat modified. Figures given in the paper showing the light oil content were nearly all up to 160°; if they had been taken up to 200 or 220° they would have given a different aspect to the result.

Mr. J. K. Lord, Senior Vice-President of the Association, said, if the North Western Board approved, a similar type of plant would be installed at Stockport.

'An investigation into the quality of domestic coke' was the title of the third paper, submitted by Mr. Peter Tipping, of the Rochdale undertaking. He said the progressive development of coke markets depended equally on the supply of coke of consistent quality, and correct installation of appliances of proved performance standard. These appliances and the fitting of them were in the hands of other departments; the production side was responsible for the quality of the coke.

Bearing in mind the spread of smokeless zones and the subsequent use of coke for domestic purposes in appliances of limited flexibility, for the time being, it had become more necessary than ever to provide coke of good and constant quality. Quality depended on the following properties: Size, reactivity, bulk density, moisture and ash. These were dealt with at length in the paper.

Mr. J. Wilson, General Manager, Manchester Group, stressed that but for coke the price of gas would be very much higher. It was important it should be of the right quality and size. There was a considerable loss of revenue due to breeze content. An increase of 16% discovered when the coke reached the weighbridge cost his group £200,000 a year.

In further discussion, it was pointed out that the moisture content of coke should be kept down and the question deserved very serious consideration. While undertakings had to pay for the moisture content in coal and slack they were losing the moisture in the saleable product.

Mr. Nicklin said there should be an investigation into the breakage of coke in the bunkers. The time had come when something should be done about controlling moisture. That was a job for the chemist. There should be a process whereby coke stored should not suffer from the inherent fault of picking up moisture.

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FIG. 153 **GOVERNORS**

FIG. 154 **CUT-OFF VALVE WITH PUSH BUTTON CONTROLLED WEEP RESETTING**

FIG. 155 **COMBINED GOVERNOR AND CUT-OFF VALVE**

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The post is pensionable and the successful applicant will be required to pass a medical examination.

Applications giving details of education, training and experience together with the names and addresses of two referees should be addressed to reach the undersigned not later than January 26, 1957.

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Divisional General Manager.

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January 3, 1957.

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DUMFRIES DISTRICT
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Applicants should be experienced in the control and maintenance of gasworks plant, and a knowledge of Continuous Vertical Retorts and Carburetted Water Gas Plant would be an advantage.

The salary applicable to the post will be within A.P.T. 4A, Provincial 'A' of the Salary Scales of the National Joint Council for Gas Staffs (£535/£615) with placing according to qualification and experience.

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Application in writing to the Divisional Production Engineer, Gas Works, Gloucester Road, Cheltenham.

NORTH THAMES GAS BOARD

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Applications, giving age and full particulars, to Staff Controller, North Thames Gas Board, 30, Kensington Church Street, W.8, quoting reference 666/324.

WEST MIDLANDS GAS BOARD

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Candidates should have had extensive experience in the operation of continuous vertical retorts and automatic carburetted water gas plants and in the control of staff and labour. Corporate membership of the Institution of Gas Engineers is an essential qualification.

The salary range will be £1,105 × 40 — £1,265 (Senior Offices Salary Group B). The post is pensionable and the successful candidate may be required to pass a medical examination.

Applications stating age, experience and qualifications, together with the names of two referees, should be addressed to the Industrial Relations Officer, West Midlands Gas Board, 6, Augustus Road, Edgbaston, Birmingham, 15, to reach him not later than January 21, 1957.

J. C. INGRAM,
Secretary to the Board.

WEST MIDLANDS GAS BOARD

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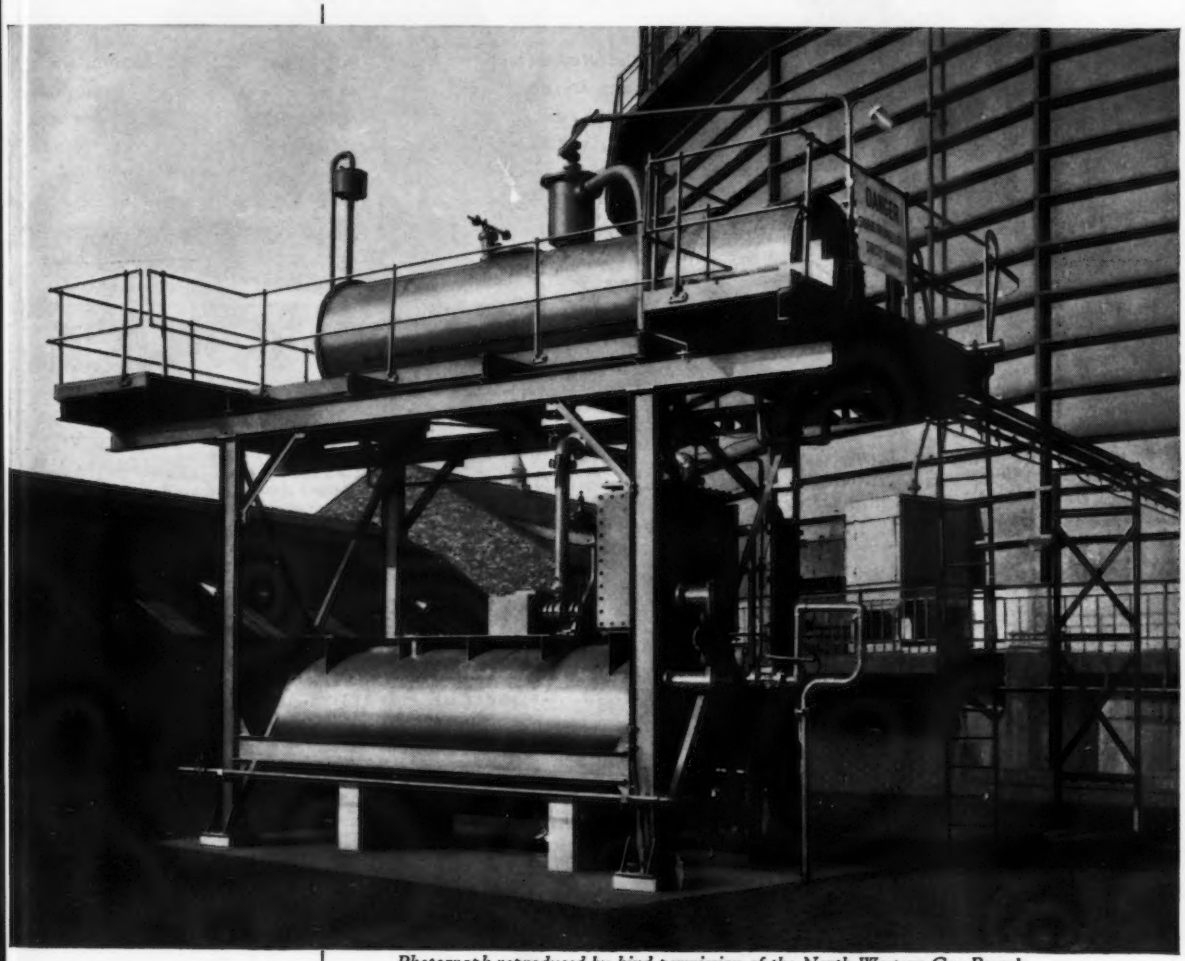

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The illustration shows the plant installed at the Bradford Road Works, Manchester, for dehydrating the sealing tar for the waterless holder.

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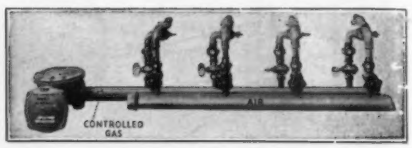

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